BOSTON UNIVERSITY

COLLEGE OF BUSINESS ADMINISTRATION

THESIS

International Aspects of the Petroleum Industry

by

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"He who owns the oil will own the world, for he will rule the sea by means of the heavy oils, the air by means of the ultra-refined oils, and the land by means of petrol and illuminating oils. And, in addition to this, he will rule his fellow men in an economic sense, by reason of the fantastic wealth he will derive from oil - the wonderful substance which is more sought after and more precious than gold itself."

Excerpt from letter written
by Henry Berenger, the
French Senator, to Clemenceau
on December 12, 1919.

LIST OF TABLES

INTRODUCTION

Eight years ago foreign developments seemed to be of little importance to the American petroleum industry. Yet, within the past few years considerable attention has been attracted by foreign oil production and refining. However, much that now appears to be significant in the world oil problem had its inception prior to the present decade.

In recent years the increase in the number and capacity of foreign sources of crude petroleum, considerations of national economy, and improvements in refinery technology have contributed to the establishment of petroleum refineries in many foreign countries and to increases in capacity and efficiency of refineries in countries that had oil plants.

The development of the petroleum industry abroad is of intimate concern to the American industry because of the position of petroleum products in our export trade. Exports of petroleum products as a group take third place among major classifications of American exports and rank second among manufactured or processed commodities exported. Machinery and manufactured cotton are the only other exported commodities that exceed petroleum products.

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American refined products is affected in no small measure by the refining capacity of foreign countries. This is indicated by the exports of gasoline. The United States exported 6,543,000 barrels in 1921 and 63,195,000 barrels in 1930, with a consistent increase in each intervening year. The ratio of American exports of gasoline to the world's exports was not so favorable, for while the United States supplied 45 per cent of the gasoline exported by the ten leading gasoline exporting countries in 1921, which rose to a peak of 72 per cent in 1924, the ratio declined to 49 per cent in 1930. Obviously, foreign refining capacity is increasing more rapidly than foreign demand for refined petroleum products.

The growing production of crude petroleum and the development of refineries abroad, with the resultant competition in refined petroleum products, make it increasingly important that the American producer and exporter should keep posted concerning foreign markets and their trend.

The United States occupies an outstanding position in the international trade in these products, its foreign sales of such products being about equal to that of the rest of the world combined.

In the following thesis, the first part will be devoted to the oil industry in general, dealing with its history, the various phases of the industry by which the crude product is manufactured into usable and marketable products, the demand for and utilization of the products, and finally, consideration of its waste and possible methods

concerning its conservation.

The second part of the thesis will treat more specifically with the producing and refining industry and activities in foreign countries. Also, American participation in the world markets will be considered and this section will include statistics and remarks on exports and imports of crude petroleum and its refined products by quantity and by country of destination or source.

CHAPTER I

HISTORY

First Evidence of Crude Oil

Crude Petroleum is an oily liquid, composed principally of carbon and hydrogen, in addition to some sulpher, a little oxygen, and certain nitrogenous substances. Evidence of this crude petroleum in ancient times was shown by the fact that its compounds played an important part in building operations. Modern excavations in Assyria and Babylonia revealed fragments of brick with an asphalt cement clinging to them. Water-tight cisterns with similar material used as coating for their walls have also been discovered. The pitch said to have been used to cement the seams of Noah's Ark and the same substance used in building the Tower of Babel is believed to have been a mineral product associated with petroleum. The petroleum saturated soil on the Russian shore of the Caspian Sea, which, even now, bursts into flame when a lighted match is applied to it, is supposed to have furnished the source of the sacred everlasting fires to which the Parsees made their pilgrimage from India and for the worship of which they built the Temple of Surakkany. Petroleum figured in the pharmacopoeia of the ancient Chinese, who considered it valuable because of its curative qualities. Even the Indians of North America before the coming of the white man were known to have used it as a medicine and lighted it in honor of the Gods. Later on, early American pioneers, pushing forward over the Alleghenies, discovered it in their search for

salt, near the salt brine, secured from drilled wells. (1) At this time petroleum was looked upon merely as a nuisance since its value as an illuminant had not yet been recognized. (1)

Early Experiments

In the year 1847 an Englishman named James Young made some experiments in distilling oil from coal and afterwards from the rich oil-bearing Scotch shales. Young took only a theoretical interest in these experiments, for no one knew then of any practical use for this oil. His experiments were very successful and Young discovered that his petroleum found eager purchasers outside of England, namely, in Berlin. Stohwasser, a lamp manufacturer in Berlin, had been trying to make a lamp capable of burning a lighter and more fluid oil, and after experimenting for years, achieved success in 1853. He obtained a sample of Young's Scotch petroleum, and as it made splendid fuel for his lamp, he immediately attempted to get control of this cheap and apparently worthless oil. Thus the birth of the modern lamp and discovery of a fuel occurred, the practical utilization of which was to grow to immense proportions within a few years. (2)

The paraffin lamp was soon known and used all over Europe. The various natural deposits of oil in Galicia, Roumania, Alsace, North Italy and other places in Europe were thoroughly exploited and could not satisfy

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1: Stocking,G.W. - "The Oil Industry and the Competitive System" - p. 6
2: Mohr,A. - "The Oil War" - p. 7-8

the greatly augmented demand. It was known that there were vast oil fields in the Caucasus, but political conditions prevented its exploitation. (3)

By the middle of the nineteenth century, kerosene, or better named "coal oil", had been refined in this country for illuminating purposes by the distillation of cannel coal. During the succeeding years its use became more widespread, especially in Eastern cities. In 1854 Jonathan Eveleth and George Bissell, New York lawyers, conceived the idea of securing a cheaper illuminating oil from crude petroleum. They journeyed to Western Pennsylvania where oil seeps were known to occur. They secured a sample of petroleum near Oil Creek which they sent with a request for an analysis to Professor Benjamin Sillman of Yale University, one of the most noted chemists of his day. Professor Sillman reported that he found in the sample the source of a good illuminant and a good lubricant. Encouraged by this report, Bissell and Eveleth organized the Pennsylvania Rock Oil Company for the purpose of oil production. They achieved little success and after 1858 the Company was unheard of. (1)

In 1859 James M. Townsend, a New York lawyer who had been one of the original stockholders in the Pennsylvania Rock Oil Company, obtained the services of E. L. Drake (a man with apparently no special qualifications for the task, having been formerly a conductor on the New York and New Haven Railroad) to make another attempt in the Oil Creek region to obtain petroleum in commercial quantities.

3: Ibid - p. 8-9
1: Stocking, G.W. - Op. Cit. - p. 7

Drake's efforts proved successful and small quantities of petroleum were secured from oil springs and sold on the market for twenty dollars a barrel. With an idea of increasing production, it was decided to drill a well and,if possible, find the source of oil. (2) Work was begun in the early part of 1859, and in August of the same year, at a depth of sixty-nine feet, the hole filled half full of fluid. A small pump was installed and the well yielded about one thousand gallons of oil daily. (1)

Within a few years petroleum became the main dependence of civilized communities for illumination. In 1860 its sole use was as a source of refined kerosene,which served for purposes of illumination, as a superior substitute for whale oil, tallow candles, and "coal oil".

The process of distillation was simple since the crude still which had formerly been used in the distillation of coal oil was readily adapted to the new industry. This process yielded benzene, gasoline, kerosene, paraffin, and a residuum of tar. The demand for gasoline was small at first and there was a constant tendency to mix it with commercial kerosene despite the increased danger of explosion. The commercial traffic in "coal oil" had already attained considerable development. (~~2~~) 1

In the very year that Drake discovered oil,Mervil and Donner, refining chemists in Boston, distilled 7500 tons of coal, and were said to have cleared $100,000. (3)

2: Ibid - p. 7
1: Stocking,G.W. - Op. Cit. - p. 7
2: Ibid - p. 8-9
3: Ibid

The Drake well was completed in August 1859, and during the remaining months of the year, it produced two thousand barrels of oil, which sold on the market at twenty dollars a barrel. Enormous profits, foreseen by a speculative public in this industry, brought on a veritable oil boom. The result was a phenomenal increase in production and the problems of storage and transportation became really serious. There were not enough barrels in America to handle the increased output, nor were the reservoirs dug in the earth adequate, as the loss from evaporation, from capillary attraction, and from fire was great. Necessity led to the construction and use of large wooden tanks, which, in turn, gave way to the economical and durable iron or steel tanks which are used today. (1) 2

Early Difficulties

In about the middle of the sixties the whole oil industry had been organized on a regular, legalized basis.

A big difficulty at the outset proved to be in restraining the oil from gushing forth day and night. Due to lack of storage facilities, the oil overflowed, often forming regular lakes or rivers in the surrounding territory. The gushing stream often caught on fire, due to its large natural gas content. (2)

These difficulties were soon overcome, however, and a new problem arose in the bitter and unscrupulous rivalry of various oil refineries. There were about two hundred and fifty of them in the United States by the late sixties and they controlled the price, not the producers.

1: Stocking, G.W. - Op. Cit. - p. 9
2: Mohr, A. - Op. Cit. - p. 20

Cut-throat competition became such a menace that production almost came to a standstill in 1870. It therefore became evident that a powerful organization, capable of uniting the many conflicting interests under joint control, was sorely needed. (3)

Rise of the Standard Oil Co.

The man to create such an organization appeared at this time in the person of John Davison Rockefeller, who was then barely thirty years old. He gained his first commercial experience as a bookkeeper. His connection in the oil industry dates from 1862, when his firm became financially interested in an oil refinery founded by Samuel Andrews. The little sum which he invested in this undertaking gave him such a splendid return at first that he decided to give up his agency business three years later and devote himself entirely to oil. (1)

After working in partnership with various persons for several years, during which time he steadily added to his own fortune, he joined forces with his brother, William Rockefeller, who also had a large refinery, Samuel Andrews, and two wealthy New York merchants. These men united to form, in 1870, the famous Standard Oil Company. The original capital of the Company was one million dollars and it increased to three and one-half millions in 1874. Its president and moving spirit from the outset was John D. Rockefeller.(2)

At the beginning, Standard Oil owned no producing wells, and owns but a few of the wells in the United States today. Its business is, and always has been, confined

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3: Ibid - p. 21-22
1: Mohr, A. - Op. Cit. - p. 22
2: Ibid - p. 23

primarily to the refining and transporting of rock oil extracted by others. It became gradually omnipotent in this field, and for years had unchallenged power to fix the market price of the refined petroleum. (3)

Standard Oil made secret agreements with railroads, securing secret rebates for Standard Oil products and procured exclusive rights to lay pipe lines between railroad lines. No means of any description were neglected by Standard Oil in hindering the activities of its rival producers. Rockefeller was bound to exercise unchallenged sway over the oil market and unite the industry under one will. (1)

The name "trust" was applied to Standard Oil in 1882 when all the large and small companies which Rockefeller had reduced to dependence were amalgamated into one huge corporation, with a capital of some seventy million dollars. At the head of the Company were nine directors or trustees. At the time of reorganization in 1882, Standard Oil claimed control over approximately nine-tenths of the oil production of the United States. (2)

Out of an estimated world consumption of 35 million barrels of petroleum in 1882, at least 30 million barrels came from the State of Pennsylvania, where Rockefeller held sway. (3)

Up to this time, 1882, petroleum was used as an illuminant. However, Edison had introduced his first electric filament lamp in 1881 at Paris, and in 1885, Gottlieb Daimlet, the German engineer, succeeded in constructing

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3: Ibid - p. 23
1: Mohr,A. - Op. Cit. - p. 25-26
2: Ibid - p. 27
3: Ibid - p. 28

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Out of an estimated world consumption of 30 million barrels of petroleum in 1882, at least 20 million barrels came from the State of Pennsylvania, where Rockefeller held sway. (3)

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3: Ibid - p. 23
1: [illegible] - Op. Cit. - p. 25-26
2: Ibid - p. 27
3: Ibid - p. 28

the first workable gasoline engine. Both of these new inventions developed rapidly and Edison's lamp threatened to supersede petroleum as a source of illumination. (1)

In France, the real home of the automobile industry, there were no more than 1672 motor cars in 1899, while about 600 motor cars were manufactured in the United States in the same year. At the end of ten years time, United States had about a million cars, and numbers in other countries were considerable, though not so large. In addition, every new motor boat and the numerous internal combination engines in factories proved new markets for petroleum. (2)

By 1910 world production in petroleum had risen to 328 million barrels and, fortunately, machines were invented which could use this source of energy. In the years after 1910, oil was introduced as the fuel for ships in practically every fleet in the world. (3)

The organization of the Standard Oil Company was monarchial. The nine trustees, who had sovereign power to direct the Company's affairs, owned more than half of its share capital. By 1882 the original company was divided into four subsidiary companies - namely, the "Standard Oil Company of Ohio", "Standard Oil Company of New York", "Standard Oil Company of Pennsylvania", and the "Standard Oil Company of New Jersey" respectively, and the process of subdivision continued until 1911, when the trust included no less than seventy different companies. The division was only formal, for the nine trustees had control over all the

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1: Mohr, A. - Op. Cit. - p. 30-32
2: Mohr, A. - Op. Cit. - p. 33
3: Ibid - p. 34

new companies, in addition to banks, real estate properties, etc. (1)

In 1911 the oil trust was condemned as illegal by the Supreme Court of the United States because it was judged that the methods resorted to by the leaders of the trust showed that their aim was to create a monopoly in the oil industry by abnormal means. Nevertheless, the "de facto" control of the whole concern remained as before in the hands of the old company, the Standard Oil Company of New Jersey, whose capital had increased to 600 million dollars. (2)

Rise of the Royal-Dutch-Shell Company

The Royal Dutch Company was founded at the Hague in 1890 and was formed for the purpose of extracting crude oil in the Sunda Islands. Its capital amounted to 1,300,000 florins. It received important concessions, especially in Sumatra, from the Dutch Government. The sale of crude oil during the first few years failed to come up to expectations and the Company, at the suggestion of Mr. Kessler, its able director, erected a refinery at Batavia, also increasing its capital to 1,700,000 florins, but paying no dividends. (3)

By 1894 the Company was in position to pay a dividend of 8 per cent and in the following year it paid no less than 44 per cent, although the capital had been increased to two and one-third million florins. The peak came in 1897, when it declared a dividend of 52 per cent on a capital of five million florins. (4)

1: Mohr,A. - Op.Cit. - p. 38
2: Ibid - p. 42
3: Ibid - p. 52
4: Ibid - p. 52-53

At this time Rockefeller turned his attention to this young and aggressive rival and tried hard to crush it, as he had done to so many other competing enterprises. Nevertheless, after ruthless attempts to buy up the majority shares in Royal Dutch and to wage financial war on this same company in every place where it had established offices for the sale of oil, e.g., by selling oil below cost, the Royal Dutch emerged victorious, and subsequently, Standard Oil gave up the fight in 1901. (3)

Its victorious fight was due for the most part to its intimate connection with the Rothschilds, Europe's most powerful banking firm. In addition, it had a man of force and brilliant foresight, Henri W. A. Deterding, the future director-general of the Company, who made Royal Dutch the financial world power which it is today. He was mainly responsible for getting the Rothschilds' aid. (1)

The Royal Dutch sold its production in oversea markets and had used most of its profits in laying down pipelines and building plants. It owned very few tankers at this time.

Another oil company, the Shell Transport and Trading Company had some of the largest and best equipped tankers afloat. Its owner and founder was Sir Marcus Samuel, and Englishman, whose original business had been in sea-shells. He had obtained important oil concessions, especially in Borneo. (2)

Thus, circumstances made Shell and Royal Dutch bitter rivals, the former controlling transport, the latter

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3: Mohr, A. - p. 53
1: Ibid - p. 54-55
2: Ibid - p. 56-57

controlling production.

Finally in 1902 they both came to terms and established the Asiatic Petroleum Selling Company to take over and sell all its production and handle all its tankers. The share capital of Asiatic Petroleum was divided into three parts: one-third being held by Royal Dutch, one-third by Shell, and one-third by the Rothschilds in Paris respectively. The new combine adopted the name of the Royal-Dutch-Shell, which is, in reality, a holding company like the former Standard Oil Company of New Jersey. The actual business is transacted by two subsidiary companies, the British "Anglo-Saxon Petroleum Company" and, more especially, the Dutch "Baataafsche Petroleum Maatschappij", both founded in 1907. On the board of management of Baataafsche Petroleum Maatschappij there are seven Royal Dutch and three Shell representatives, while 60 per cent of Anglo-Saxon's capital belongs to Royal Dutch and 40 per cent to Shell. (3) Therefore, the Dutch interest predominates in both companies,but Dutch capital is not predominant in the Royal Dutch. The French have an interest, due to the Rothschilds, and the British interest is very large, though this cannot be proved by documentary evidence. (1)

The Baataafsche subsidiary took over the management of all property, refineries, pipes, etc., in the area of production while the Anglo-Saxon subsidiary undertook the storage and transport of the finished product which was finally sold through Asiatic Petroleum. (2)

3: Mohr,A. - Op.Cit. - p. 57-68
1: Ibid - p. 58
2: Ibid - p.59

The number of companies included in the Royal-Dutch-Shell trust is estimated to be quite large and they cover widely differentiated activities as well as controlling a vast field of operations. They have bought or got control of producing fields all over the world as well as having sold their refined products in all the world's markets. (3)

In 1912, Deterding purchased a number of important oil fields in Western America, and founded a new company: California Oil Fields, Ltd. This company was soon followed by others: the Roxana Petroleum Company of Oklahoma, the Roxana Petroleum Corporation of Virginia, the Shell Company of California, and a number more. They also went into Mexico and Central America, first with the La Corona Company and then with the gigantic Mexican Eagle Company. They even thrust themselves into Venezuela and Trinidad. (4)

Deterding won over Great Britain's powerful support for his company. All over the world today the Royal-Dutch-Shell and the Anglo-Persian Oil Company are the leading representatives of the British State in the fight for possession of oil fields. In order to safeguard Great Britain's oil supplies during the Great War, Deterding placed himself and his company at their disposal. In return, the British Government rewarded the Royal Dutch with its active political backing. (1)

Anglo-Persian Oil Company, Ltd.

Another oil company which has gained considerable

3: Mohr, A. - Op. Cit. - p. 60
4: Ibid - p. 63
1: Ibid - p. 63

prestige in the world's oil industry is the Anglo-Persian Oil Company, Ltd. This Company was registered in London in 1909 to work a concession (originally obtained from the Persian Government by William Knox D'Arcy), which runs for 60 years from May 28, 1901, and gives the exclusive right to drill for, produce, pipe and carry away natural gas, petroleum, asphalt, etc., throughout the Persian Empire, except in the provinces of Azarbaijan, Gilan, Mazandoran, Astrabad, and Kurasan, i.e., an area of about 500,000 square miles (1)

After much unsuccessful drilling in the neighborhood of Qast-i-Shirin and elsewhere, oil was struck in large quantities in the year 1908 at Masjid-i-Sulaiman, about 30 miles east of Shuster in the province of Khuzistan (South-West Persia). (2) By 1913 the company was in need of further capital and, as the British Admiralty was then anxious to secure fresh sources of supply for its fuel oil, the Government entered into an agreement whereby they agreed to subscribe for 2,000,000 ordinary shares and 1,000 preference shares, out of a total capital of 4,000,000 shares and further subscribe for 199,000 pounds of debentures in the Anglo-Persian Oil Company. This act of Parliament was followed by another in 1919, when the Company's capital was raised and the Government's subscription increased to 5,000,000 ordinary shares, keeping intact the Government's control. (3) This control still subsists.

Through the British Tanker Company, Ltd., the Anglo-

1: Encyclopedia Britannica
2: Ibid
3: Mohr, A. - Op.Cit. - p. 127

Persian Oil Company controls some 80 tank steamers, all built in Great Britain, and having a total carrying capacity of over 700,000 tons; and through subsidiary companies it operates refineries in South Wales, Scotland, and (through associated companies) in France, Australia, and Argentina. The greater part of the present crude production is refined at Abadam in Persia. The Company's main production is still obtained from Masjid-i-Sulaiman and is conveyed by pipe lines to its refinery at Abadam on the Shatt-el-Arab, a distance of 145 miles. (2)

By this concession the Persian Government takes a cut of 16 per cent on the yearly net profits of the Anglo-Persian Oil Company. Also, this Company employes 26,000 persons, most of whom are Persians. (3)

"British Controlled Oil Fields"

The Anglo-Persian Oil Company was no longer sufficient for Great Britain's needs in 1918, and they found a new company, the "British Controlled Oilfields", specially commissioned to fight the Standard Oil. Like the Anglo-Persian, it was entirely in the hands of the British Government under the system of the Voting Trust. Thus Great Britain had three big companies with which to search for and control the oil fields of the world. (4)

Russian Oil Companies

The modern Russian petroleum industry first came into existence in 1873 although the oil wells of Baku, in the

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2: Encyclopedia Britannica.
3: Ibid.
4: Denny - p. 10

Caucasus, seem to have been known in ancient times. It was founded by Robert Nobel, an elder brother of Alfred Nobel, the Swedish founder of the Nobel prizes. With a third brother, Robert Nobel managed an arms factory that his father had erected at St. Petersburg. On a business journey to the Caucasus early in the seventies he discovered the rich oil wells on the Apscheron peninsula at Baku and with his first-rate technical and commercial education, was well aware that petroleum extraction had already become a great industry in the new world. After several years experimental work at Baku, he and his brother, Ludwig, founded, in 1876, the old firm, Nobel Brothers, which they maintained as the premier Russian oil firm until the Bolsheviks socialized the whole industry in 1917. In 1913 its capital had increased to 30 million gold roubles (rouble approximately 50 cents) and controlled about 14 per cent of the Russian production of petroleum. (1)

The firm of Nobel was not only the founder, but also the leading firm in the industry both as regards technical developments and treatment of its employees. They laid the first pipe line in the Caucasus, and constructed the first tank wagon there for the transport of oil. (2)

A pipe line was laid by the Russian State from Baku to Batum in the nineties. This was completed in 1906 and gave their oil a transportation outlet by way of the Black Sea to other markets. The Russian petroleum industry found a market so large, and at the same time so easily accessible,

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1: Mohr,A. - Op. Cit. - p. 68-69
2: Ibid - p. 69

that since the close of last century Russia has exercised a constantly declining influence upon the international petroleum industry. In the 'nineties the Russians still exported to the Orient and Far East considerable quantities of petroleum, but this almost entirely ceased by 1913, due to severe competition from Standard Oil and the Royal Dutch, with their big, up-to-date tankers, although it was also due to the increasing demand in the Russian market. All sales in the Russian market were made from large reservoirs and tanks established and controlled by the State. (1)

Caucasian petroleum did not have the Russian market all to itself, however. Owing to the long distance and the high railway freights,it had great difficulty in competing in North Russia, strange as it may seem, because of the American oil imported by the infinitely cheaper sea route.(2)

All the oil fields in the Caucasus were at first State-owned. However, in the seventies, a very considerable part of this oil-bearing country was either sold by auction or leased. In both cases the State stipulated that it should receive a certain percentage of production. (3)

Much of the capital in these sales by auction was foreign. It was partly Swedish (Nobel Brothers), and especially English, and French capital (The Rothschilds). The latter owned two large companies, the "Societe de Mazout", which seems to be chiefly a selling company. Both companies were taken over in 1912 by the Shell Transport and Trading Company. (4)

1: Mohr,A. - Op. Cit. - p. 70-72
2: Ibid - p. 72
3: Ibid - p. 73
4: Ibid - p. 73

Internationally, the position of the Russian Oil industry was weakened by the fact that it was not subject to the directive control of a single company in contrast to the American or West-European oil industries. It had always been in the hands of a large number of companies of pretty nearly the same strength, whose capital was derived from various foreign countries:-- Sweden, France, England, etc. The result was that the Russian oil industry never became a monopoly up to the time when the Soviet Government came into power. (1)

When the Soviet Government came into power and confiscated all the fields under exploitation, they organized the petroleum industry as a Government monopoly, the control of the industry being vested in a number of trusts charged with conduct of the various phases. Unit control is possible on account of Government ownership and operation of all the oil fields. Absence of property lines and lease obligations permits the development of each structure in accordance with the best judgment of the technologists in charge. (2)

Introducing Kerosene into China

The Standard Oil Company was responsible for teaching the Chinese how to use lamp oil. They did this by distributing, at first gratis, and afterwards, when this became too expensive, at cost price, hundreds of thousands of cheap oil lamps, each of which bore the inscription Mei Foo - Good Luck. China had a population of 400 millions

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1: Mohr,A. - Op. Cit. - p. 75
2: Institutions of Petroleum Technologists Journal, March 1934 - p. 126a

and was a safe and unlimited market for American petroleum.(3)

But Mr. Deterding of the Royal Dutch interfered with Standard's plans because he was able to sell the Chinese petroleum at a price considerably below that which the Americans could afford to ask, thanks to the circumstance that his oil fields were much nearer, and the expense of transport proportionately lower. (4)

Summary

To sum up, we have witnessed the evolution of petroleum from a dirty oily liquid, looked upon as a nuisance, to almost a necessity of life as a source of energy, a source of heat, and a source of light.

Its discovery resulted in the birth of a new industry and the consequent employment of millions of men. As we shall see in a later chapter, its products are used in virtually every factory, vehicle, and home.

Its rise has been swift. In reality, the petroleum industry is only about seventy-five years old and it continues to grow yearly.

We have seen the struggle of the two great oil giants, the Standard Oil Company and the Royal-Dutch-Shell, each trying to outdo and outguess the other.

Finally, we have perceived the growth of the Anglo-Persian Oil Company in Persia and the beginning of the Russian oil industry in a country where the oil resources are not yet fully developed, but which have proven to be limitless at the present time. This is the country which

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3: Mohr,A. - Op.Cit. - p. 61
4: Ibid - p. 61-62

will surpass United States in production in the near future when the reserves of this country have been used up.

The next chapter will deal with the oil industry itself in all its phases.

CHAPTER II

THE OIL INDUSTRY

Nature and Origin of Petroleum

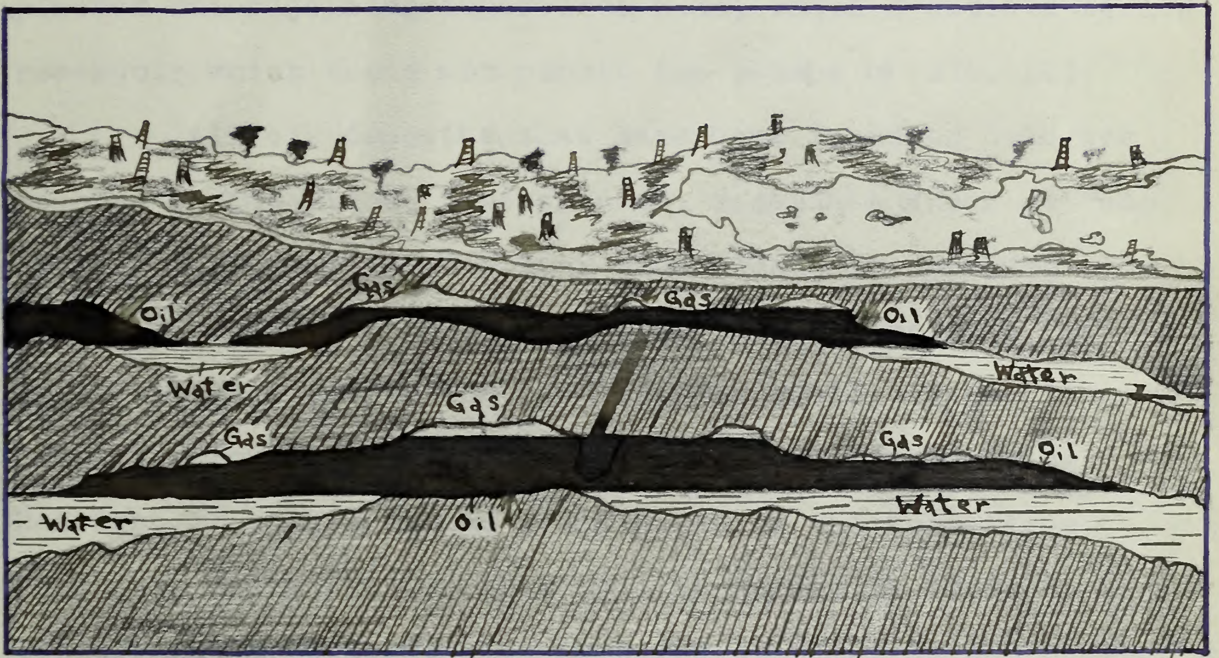
It is now most generally believed by geologists that crude petroleum has been formed from the organic remains of marine, plant and animal life. This material was laid down along ancient seacoasts, in lagoons, swamps, and deltas, in water-deposited shales and clays, where complete oxidation was prevented by the quiet nature of the waters. Other beds of material have been superimposed on this, until a thick covering has been forced. Time, pressure, and heat have brought about changes in these organic remains which have resulted in the formation of petroleum. Time has been the most important factor, for petroleum is the result of thousands and even millions of years. (1)

While the data concerning the reservoirs in which oil accumulates are more abundant and exact than the information relating to its origin, little is definitely known concerning the relationship between these reservoirs and probable source beds, and much is to be learned about the structure of oil fields. The most common type of reservoir rocks are known technically by their shapes as "anticlines", "monoclines", and "domes". These are simply the higher parts or folds or wrinkles in the beds of rock. (2)

1: Stocking, G.W. - "The Oil Industry and the Competitive Systems" - p. 124
2: Osborn, C. - "Oil Economics" - p. 67

Geological Aspects

When a geologist refers to "rock", he means any form of soil, clay, or shale, sand, and lime, or hardened forms of these materials. With the exception of "igneous" rocks, which were formed by the cooling and hardening of molten rock after intense heat and which is supposed to make up the Earth's core, the mantle rocks, including portions of these hard igneous rocks, have been worked over many times by erosion and deposition. Water, wind and temperature changes



View of the Occurrence and Mining of Oil and Gas

are the principal agents of erosion. (1)

The beds of rock have been subjected to pressure and heat at possibly very great depths and were thus wrinkled and folded like a newspaper when laid upon a table

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1: Osborn, C. - Op. Cit. - p. 67

and subjected to stresses and twisting with the hand. In some places the formations have been broken or have slipped, producing what is technically called a "fault". (2) In a few places, e.g. Mexico, molten rocks have been pushed upward into the mantle rocks, where they formed "plugs" or "sills" against which oil has accumulated. Petroleum is also known to have accumulated in sand and limestone bodies adjacent to buried mountain ranges and old shore lines. In a few instances oil is found under conditions where there is apparently no structure, except lenses of sand that have pinched out adjoining impervious beds, which created a sealed reservoir which would not permit the escape of oil. (1)

All oil deposits that have been found to date are covered by impervious beds of rock, sometimes known as "cap rock". The producing horizons vary widely in porosity and degree of consolidation, both of which are important factors in the rate of production and ultimate yield. Water is generally found in the same layer as the oil, but being heavier, it occurs in the lower parts of the formations. Free gas, being lighter than oil, is generally found at the top of the structures. The pressure of the free and occluding gases in solution, and of the water, forces the oil into the hole and to the surface, when the bit penetrates the cap cock. (2)

The problem of the geologist is to find subsurface structures that will produce oil. The large proportion of them are found to be barren when drilled because:- they are

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2: Osborn,C. - Op. Cit. - p. 68
1: Ibid - p. 68
2: Ibid - p. 68

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2: Osborn, C. - Op. cit. - p. 55
1: Ibid - p. 56
2: Ibid - p. 56

not adjacent to source beds, conditions were not favorable for the accumulation of the oil in commercial quantities from its original sources, or the oil, if present at one time, has escaped. The chances are obviously better for finding oil in structures than elsewhere, but there is no positive way to locate structures or oil in advance of drilling. Geological methods and knowledge are helpful, though not conclusive, in locating structures which may or may not contain oil. (1)

Methods of Locating Oil Beds

The location of the first well was determined by the presence of oil seepages at the earth's surfaces. Since that time, chance has played the greatest role in oil exploitation, and the willingness on the part of investors to stake their "all" in a"wildcat" search for oil, have accounted for the discovery and development of new producing areas.(2)

Various means are used for locating the structures. Where outcropping rocks are available, they are helpful, because beds close to the surface frequently indicate the position of deeper beds. Core drilling is also employed because it gives a cross section of subsurface formations to a depth of several hundred feet. The seismograph, which records the time interval between the release of a sound wave into the earth and its return from underlying beds, is also used. This instrument has long been used to record earth tremors and for ocean sounding. Other geophysical instruments lately used are the torsion balance, gravity pendulum, and magnetometer. (3).

1: Osborn,C. - Op. Cit. - p. 68-69
2: Stocking,G.W. - Op. Cit. - p. 137
3: Osborn,C. - Op. Cit. P. 69

Methods of Bringing Oil to the Surface

Wells vary from a few hundred to nearly 10,000 feet in depth, and cost from a few thousand dollars to nearly $250,000 each. The number in excess of 7,000 feet deep is relatively small. The wells are put down with rotary or cable-drilling tools and cased or lined with metal pipe. Cable-drilling equipment "makes hole" by successively raising and dropping a heavy sharpened bit at the end of a wire rope, and literally punching its way through the earth's crust. Many weeks of rhythmic impact by the bit at the bottom of the hole and much time for the purpose of lowering and setting the casing are usually required to complete a well. The holes are large at the surface and small at the bottom, and the completed hole resembles a telescope. An experienced cable tool driller can determine the general physical character of underground formations by the "feel of the line". The principal feature of a rotary rig is the drill pipe, which is rotated in the hole with a bit at its end. Derricks or towers are erected for the purpose of raising or lowering the tools and "strings" of jointed casing. Drilling equipment and metal pipe are heavy and much power must be delivered to the derrick floor. A test located in an area remote from production is called a "wild-cat". (1)

The hydraulic rotary rig is used in very soft and unconsolidated rocks where it is impossible to carry on drilling with standard tools due to constant caving of the walls of the hole. The drilling stem is composed of lengths of pipe screwed together, the top length being square, the

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1: Osborn,C. - Oil Economics" - p. 8-9

remainder round. The walls of the hole are kept from caving by means of circulating mud, which is forced by pumps through a swivel at the top of the drill stem, and back on the outside of the stem. The circulating mud "plasters up" the walls of the hole so that they will stand while the drilling stem is being removed and the casting set. (2)

The peak of production of an individual well is reached very early in its life, after which a steady decline sets in. Likewise, individual pools sooner or later reach a maximum output with the consequent but perhaps prolonged decline. The decline of production of pools is offset and interrupted by the discovery of new pools and the extension of old ones. (1)

Since the beginning of the industry until the present time, oil production has remained, for the most part, highly competitive. A monopoly control was soon established in the transporting, refining, and distributing branches of the industry; but a monopoly of oil production has been impossible in the absence of legislation regarding it. The exact location of an oil pool is a speculative affair. The uncertainty of the occurrence of petroleum, coupled with its migratory nature, has rendered a monopoly of oil production impossible. The same factors, coupled with the rich return afforded, have made the industry highly competitive. (3)

The natural gas associated with the underground petroleum supply is valuable both as a fuel and as a source

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2: Snider, L.C. - "Oil & Gas in the Mid-Continent Fields" - p. 54 - (Oklahoma City, 1920)
1: Stocking, G.W. - Op. Cit. - p. 126-127
3: Ibid - p. 131

of energy in recovering the oil. When present in sufficient quantity and under sufficient pressure, the gas forces the oil to the surface in great volume, hundreds, thousands,and even hundreds of thousands of barrels sometimes gushing forth in a single day. The total amount of oil recovered varies, in the main, with the amount of utilized gas pressure. When the pressure has been exhausted, oil recovery becomes a more expensive process, the daily recovery being greatly lessened and the process extending over a greater period of time. With increased depths, pumping becomes very much more expensive, and in some localities where the depth is very great, it may not be profitable and consequently wells are sometimes abandoned when the natural flow has subsided. (1)

Characteristics

Oils may be divided into the following three classes:

1. Paraffin-base or light petroleum rich in gasoline, wax, and high-grade lubricants.

2. Heavy naphthene oils, commonly called asphalt-base petroleum, usually low in gasoline and frequently high in asphalt. (2)

3. Mixed or intermediate crudes, having the characteristics of both other grades. (3)

Oil ranges in color from yellow to brownish black. Some petroleums are transparent, but most of them appear

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1: Stocking,G.W. - Op. Cit. - p. 134-135
2: Osborn,C. - Op. Cit. - p. 66
3: Osborn,C. - Op. Cit. - p. 66

opaque. The color of oils by reflected light, sometimes called "bloom" or fluorescence, usually ranges from olive green through brown to almost jet black. Ordinarily the greener, the "bloom", the better are the qualities possessed by the oil. (2)

Oil is lighter than water, and when they are poured into a container, the petroleum rises to the top. The weight or gravity of oil is expressed in degrees read from a gravity scale allowed to float in the fluid. It may also be designated by specific gravity compared to water. Most of the crude oils produced in the United States range in gravity from 47 degrees A. P. I. (standard scale recommended by American Petroleum Institute in co-operation with U. S. Bureaus of Standards and Mines for use in classification of oil) for the paraffinaceous grades to 14 degrees for the heavy naphthene or asphaltic types of California. Mexican oils range in gravity from 12 to 21 and Venezuelan crudes from 18 to 36 degrees. (3)

The weighted average gravity of the crude petroleum produced in the U. S. for several years prior to 1925 was about 31 degrees A. P. I. Since 1925 it has been a little over 32 degrees. Most of the heavy oils are produced in California and southern parts of Texas and Louisiana. (4)

<u>Occurrence and Geographic Distribution in the United States.</u>

The petroleum and gas producing pools of the U. S. may be divided up into the following seven major regions:

1. <u>The Appalachian Region</u>

Embraces the oil-producing pools in Southwestern New York, Western Pennsylvania, Eastern Ohio, Northwestern West Virginia, Kentucky, and Northern Tennessee. The oils

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2: Osborn, C. - Op. Cit. - p. 66
3: Ibid - p. 66-67
4: Ibid - p. 67

are mainly paraffinaceous, relatively free from asphalt and objectionable sulphur, and range in gravity from 23 to 47 degrees A. P. I. They yield high percentages of gasoline by straight-run distillation, somewhat proportionate to relative gravities and are first class sources of high grade motor lubricants. This region has been producing oil for nearly 75 years. Most of the wells are small settled producers. (1)

2. The Lima-Indian Region

Includes the producing fields of northwestern Ohio and eastern Indiana. The oils are paraffin bearing, containing a small proportion of asphalt, and range in gravity from 30 to 37 degrees A. P. I. Many of these oils contain sulphur compounds and must be treated before they can be charged to stills to eliminate their corrosive effect. This area was opened in 1885. It is only a small contributor to the national supply. (2)

3. The Illinois-Southwestern-Indiana Region

Embraces fields in southern Illinois and neighboring Indiana pools. Oils contain varying quantities of both paraffin and asphalt, and range in gravity from 28 to 40 degrees A. P. I. A little sulphur is present, but not enough to be injurious. Fields in this area are settled and production has been slowly declining for many years. (3)

4. The Mid-Continent Region

Includes areas in Kansas, Oklahoma, Arkansas, northern Louisiana, southwestern New Mexico, and Texas, exclusive of the Gulf Coast. The oils produced vary widely in composition, ranging from naphthene or asphalt-base petroleum, low in gasoline, to high-grade paraffin-base crudes rich in lighter products. The gravity range of the oil lies between 18 and 46 degrees

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1: Osborn, C. - Op. Cit. - p. 69
2: Ibid - p. 69-70
3: Ibid - p. 71

A.P.I. Considerable sulphur is present in the low-grade oils and has to be eliminated because of its corrosive powers on tanks and pipe lines. (2)

5. The Gulf Coast Region

Includes scattered pools in southwestern Louisiana and southwestern Texas, most of which are associated with salt domes. This region is a large contributor of heavy asphaltic oil. The oil varies in composition, but is characterized by low percentages of gasoline. Gravities range from 18 to 30 degrees A. P. I. and large quantities of sulphur are present. (3)

6. The Rocky Mountain Region

Embraces scattered petroleum fields of Montana, Wyoming, Colorado, Utah, and northwestern New Mexico. The petroleum is mainly paraffin base and high in light products and lubricants. Gravity ranges from 20 to 50 degrees A. P. I. (4)

7. California Region

Includes fields lying along the Pacific Coast from Santa Barbara to Los Angeles Basin and inland to the San Joaquin Valley. The California oils vary widely in quality. Gravity range lies between 12 and 40 degrees A. P. I. Many of the oils are heavy and useful mainly for fuel, but much high-grade petroleum is found. (5)

Small quantities of petroleum not assigned to any of the major fields are produced in Michigan and Alaska. The Michigan Oil is high in sulphur, but that produced in Alaska is a light paraffinaceous oil. (6)

2: Osborn, C. - Op. Cit. - p. 71
3: Ibid - p. 71-72
4: Ibid - p. 72
5: Ibid - p. 72
6: Ibid - p. 72

OCCURRENCE AND GEOGRAPHIC DISTRIBUTION IN FOREIGN COUNTRIES

Venezuela (1)

The major oil region of Venezuela is situated around the Maracaibo Basin. This basin included the fields of Ambrosia, La Rosa, Punto, Beintez, and Laquillas, on the east side of Lake Maracaibo; Mene Grande, a little farther south. El Mene field, a little more distant on the northeast; La Poz and Concepcion fields, northwest of the lake near the City of Maracaibo; and Rio Palmer field, a little southwest of the La Poz field. La Tarra and Rio de Oro fields are located southwest of the lake and are connected with it by the Rio Catatumbo and its tributaries.

The other producing fields are the Urumaco field in the north central section of the State of Falcon,Hombre Pintado field a little northeast of El Mene field in the western end of the State, and the El Mene del Salto field in the extreme eastern section of the State.

The Quiriquire field is located about 25 miles north of Maturin, the capital of the State of Monagas.

Mexico (2)

There are three oil-producing regions in Mexico: The Panuco District, about 30 miles southwest of Tampico; the Dos Bocas-Alamo District, which extends for 40 miles from Dos Bocas on the Tamiahua Lagoon south of Tampico to Alamo on the Tuxpan River; and the Tehuantepec District, which lies in the Isthmus of Tehuantepec in southern Mexico.(3)

1: U.S.Bureau of Foreign and Domestic Commerce ,"Commercial and Industrial Development of Venezuela", Trade Information Bulletin No.783 - p. 27
2: Garfias,V.R. -"Petroleum Resources of the World" - p. 28
3: Ibid - p. 116-117

Colombia (1)

Colombia has five main oil districts: The Caribbean Coast District; the Pacific District; the Magdalena River Basin, containing the producing field at Los Infantas; the Catatumbo River Basin; and the Orinoco-Amazon District.

The Caribbean Coast District covers all the fields within 50 miles of the coast, and the basins of the Sinu and Atrato Rivers, where a series of parallel north-south fields, marked by mud volcanoes and gas and oil seepages, near the crest, is found. The Pacific Coast District includes the Departments of Choco and Valle, in the region of the Bando River, extending from Cali on the Cauca River to Quibdo, north of the Bando River. The Magdalena River Basin includes the part of the Cauca Basin not underlain by igneous or metamorphic rocks, the west side of the Magdalena River from Guatagui to the valley of the Cacas River near Lake Zapatosa. The Catatumbo River Basin District covers the region near the foothills at Rio de Oro and in the hills southeast of Tres Bocas. The Orinoco-Amazon Basin includes the district near the junction of the Putamaiyo and Guamuez Rivers and the Meta Valley.

Argentina. (2)

The commercially productive oil region of Argentina is confined to the Comodoro Rivadavia field, situated along the coast about 980 miles south of Buenos Aires in the territory of Chebut. The field was accidentally discovered in 1907. It is a plot of about 5000 acres reserved by the

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1: Garfias, V.R. - "Petroleum Resources of the World" - p. 116-117.

2: Ibid - p.103-104

Government and within which the greatest past of the successful development has taken place.

Peru (2)

The commercial oil fields of Peru lie in the Provinces of Tumbes and Payta, along the northern coast near the Ecuadorian boundary. The most southerly and most important field is Negritos, in the Province of Payta. About 20 miles north of this lies the Lobitos field, which is second in importance; still farther north, about 60 miles from Lobitos, is the Zorritos field. The Lobitos field lies along the coast.

Trinidad Island. (3)

The first successful wells were drilled in 1900, near Guayaguayare on the extreme southeast corner of Trinidad Island. Petroleum is produced mostly in the southern part of the island within 7 miles of Pitch Lake, and a small amount is obtained from the Barracpore field, 15 miles east, the Guayaguayare field 45 miles east, and the Tabaquite field 30 miles northeast of Pitch Lake. These fields are all included in the two main oil districts of Trinidad: The Pitch Lake District covering 120 acres, about half a mile from the Gulf of Paria and 27 miles south of Port of Spain, and the Tabaquite District which is located in Narvia County about 30 miles northeast of Pitch Lake.

Other small oil-producing fields in South America are located in Ecuador and Bolivia. Canada also enjoys a small yearly production of about 1,500,000 barrels.

2: Garfias, V.R. - Op. Cit. - p. 84
3: Ibid - p. 94

THE EASTERN HEMISPHERE

Russia (1)

The commercial oil fields of Russia lie principally in five districts. In the order of their importance they are: 1. Baku, along the southwestern shore of the Caspian Sea at the southeastern end of the Caucasus Mountains; 2. Grozny, along the northern flanks of the Caucasus and about 280 miles northwest of Baku; 3. Emba, on the northeast shores of the Caspian between Emba, Sagis, and Nil Rivers; 4. Maikop, on the northern flanks of the Caucasus, about 300 miles west of Grozny; 5. Tcheleken Island, about 170 miles east of Baku, near the eastern coast of the Caspian; and 6. Ferghana, in Turkestan, about 800 miles east of Baku.

Oil resources are also known to be located in the Western Caucasus and Black Sea District which includes the Kertch Peninsula and Taman Peninsula, southeast of the Crimean area; the region near Anapa on the shores of the Sea of Azov, the Province of Kutais, south and west of Anapa, especially in the Supsa section; the Province of Tiflis, east of Kutais and south of the Caucasus Mountains; and the Province of Daghestan in the Durbend region.

Eastern Siberia has shown evidences of petroleum especially in Minusinch, Lake Baikal and adjacent regions, Selegin District, Amur River, Sakhalin Island, and eastern Kamchatka. Russia owns the northern half of Sakhalen Island while Japan controls the southern part.

1: Garfias, V.R. - Op. Cit. - p. 26

In the book "Russia, U.S.S.R., A Complete Handbook", Mr. P. Malevsky Malevitch lists the Russian oil resources as follows: (1)

1. The Caucasian Oil Zone.

   Along the entire length of the Caucasian range oil occurs in the form of oil-wells, and frequent gas gushers. The Caucasus represents only a part of a great oil-bearing zone which continues on the other side of the Caspian Sea, through the Island Cheleken, Ferghana and the Salian Steppe to the borders of northern Persia. Efforts to organize oil-production in Georgia, where oil was discovered in 1869, are being made.

2. Baku's Potentialities.

   The original and existing oil fields, Baku and Grozny, have not yet attained their maximum output.

3. Other Oil Fields.

   The oil fields of the Caspian and the plain of Ferghana have only played a secondary roll in Russian oil industry.

4. Caspian-Ural Oil Fields.

   This oil-bearing region extends over a vast area between the N.E. shore of the Caspian Sea and the southern Urals. The extreme S.W. oil fields of this zone lie almost on the shores of the Caspian, surrounding the estuaries of the Ural and Emba Rivers. The one to the extreme N.E. is situated on the upper reaches of the river Dzhusa to the north of the Orenburg-Tashkent Railway and not far from the town of Orsk in the southern Urals.

   In this area are more than twenty oil fields, probably of great commercial value. Further to the southwest lies a belt of oil fields (along the middle course of the rivers Nila, Shgizha, and Emba) equidistant from the railway and the Caspian Sea.

1: "Russia, U.S.S.R., A Complete Handbook" by P.Malevsky Malevitch - p. 89

5. Ural Oil Fields.

There is another large oil field lying along the western slopes of the Urals. This oil field can be divided into three groups: The Ukhta basin, between the rivers Pechora and Vychegda, Chussov basin, or the middle Kana, and the Sterlitamik basin, on the river Belaya. These fields are very rich in oil and gases.

Rumania (1)

The petroleum deposits in Rumania are located along a belt 15 to 20 miles wide, extending in a rough right angle, parallel with the flanks of the Carpathian Mountains, from the Polish frontier above Bacau on the northern side of the angle, southeastward to Buzeu, the apex, and thence westward through Prahova to Dambovitza.

The fields may be grouped into four districts: The Prahova District; the Dambovitza District, west of Prahova; the Buzeu District, east of Prahova; and the Bacau District, north of Buzeu. Other sources of small account are found in the Ogtoz Valley and at Pabatlyas, Zabola, and Gelentz, in the Province of Transylvania.

Persia (2)

The presence of oil in Persia has been known from the earliest times, for Herodotus gives a detailed account of how crude oil was drawn up out of a well "near Ardericca" in a wine skin, and then poured into reservoirs until the asphalt solidified and left the lighter oil, which he said was black and very odoriferous.

1: Garfias,V.R. - Op. Cit. - p. 64
2: Davenport and Cook "The Oil Trusts and Anglo-American Relations" - p. 237-238

The kingdom of Persia has an area of 628,000 square miles, of which a round 500,000 square miles are covered by the D'Arcy Concession. Near the Karun River, in the district which the Persians call Maiden-i-Naftun, meaning "the field of oil", are situated the main wells of the Anglo-Persian Oil Company. Near the Maidun-i-Naftun field is the Maidun-i-Nafteh; and the area of these two fields, covered by prolific flowing wells, is only three and a half square miles.

Another large producing field is located near Kasr-i-Shirin, in the west, on the borders of the Mesopotamia and also in Iraq. Drilling has also been done on Qishm Island, on the lower Persian Gulf. The oil recovered is the highly-valued light gravity kind containing a large percentage of gasoline, kerosene, and lubricating oils, as well as fuel oil and paraffin wax.

Netherland East Indies (1)

The Netherland East Indies include the Islands of Sumatra and Java, the southern ports of Borneo, and many small islands of the Malay Archipelago, with a total area of 683,000 square miles. The Indies became a factor in the oil industry in 1890, with the organization of the Royal Dutch Company, which undertook, as its first venture, to prospect for oil in northern Sumatra. Commercial production was begun in 1892, and has steadily increased until at present there are commercial fields in Borneo, Sumatra, and Java, which rank sixth in the oil production of the world.

1: Garfias,V.R. - Op.Cit. - p. 49-53

In Dutch Borneo, the producing oil fields lie along the east coast, in a belt 6 to 8 miles wide, extending from the Kutei River south to Balik Papan Bay. In Sumatra there are two main producing regions: The Northeastern District between Idi and the Lepan River; and the South Central, or Palenbang District. The producing districts of Java are located on the northern side of the island, between Samarang in Java and Madura Island.

India, British (2)

The production of petroleum in India is carried on in four regions: Burma, the chief oil-producing district which is located in the upper part of Burma near the Irrawaddy River, about 300 miles north of Rangoon and 130 miles south of Mandalay; the Assam area which lies in the valleys of the Noa Dilring and Buri Dilring Rivers in northeastern Assam; Punjab area situated in the extreme northwestern section of British India, between Kashmir and Kabul; and Baluchistan area at Khatan, about 40 miles east of Sibi Station on the Quetta Branch Railway.

Poland (1)

The Galician or Polish oil fields extend along the northern flanks of the Carpathian Mountains, from the Valley of the Dunjac to the Valley of the Czeremoiz. The centre of the industry is the Boryslaw-Tustanowice District, which is the leading oil-producer, located 70 miles southwest of Lemberg. The other producing regions are Krosno, about 100 miles northeast of Boryslaw, and Kolomea, about 100 miles southwest of Boryslaw.

2: Garfias, V.R. - Op.Cit. - p. 69-74
1: Ibid - p. 77-78

Other European Oil Fields (2)

Other European oil fields of lesser importance are situated in: France, who obtained the comparatively small production of the Alsace region by the Treaty of Versailles and receives a small amount from Algeria; Italy, who has a production of about 1,250,000 barrels a year; Germany, who has an inconsiderable "free" oil production from some wells in Prussia and Bavaria; and Czechoslovakia, who has only a paltry production of about 150,000 barrels a year.

Other Eastern Oil Fields (1)

Other Eastern oil fields of lesser importance may be found in Egypt, which has an increasing production yearly; Iraq, the belt between Kirkuk and the Persian Gulf in Mesopotamia; Sarawak or British Borneo, near the Dutch East Indies; and Japan, which is steadily maintaining its own oil production, having reached her production zenith in 1915 with a yield of 3,100,000 barrels.

Types of Refineries

Petroleum refining is the principal manufacturing branch of the industry. Its function is to take all grades of crude oil through its manufacturing processes and produce the numerous products demanded by the consuming trade. Its operation starts when the crude oil is received at the refinery by pipeline or tank car and ends when the finished products are delivered to the marketing branch of the industry for distribution to the ultimate consumer. There

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2: Davenport and Cooke - Op.Cit. - p. 248-249
1: Ibid - p. 247-248

are four types of refineries: (1)

1: Skimming Plant   3: Asphalt

2: Skimming & Cracking   4: Complete

Most refineries have skimming facilities because this is usually the first process which crude oil undergoes. The products made are gasoline, kerosene, and gas and fuel oils. This type is sometimes called a topping plant. If, in addition to the skimming equipment, there are units for converting gas and fuel oils into gasoline, the refinery is called a skimming and cracking plant. If there are also facilities for manufacturing lubricating oils, the plant is called complete. Asphalt plants are operated with low-grade crude petroleum from which distillates are obtained by skimming, and fuel oils and asphaltic products are derived from the residue. (1)

1. Skimming Plant

Crude oil is a mixture of liquids that boil and vaporize at varying temperatures. The fractions that boil between certain ranges of temperature possess individual qualities which make them valuable for specific purposes. So, by heating the crude oil to a certain temperature, collecting the vapors, and cooling them by condensation to liquid form, the desired product is obtained. After having removed the first product in this way, the above process is repeated for a second group of vapors which is conducted to a separate tank. In this manner, gasoline, kerosene, and gas oil are obtained and the residue is fuel oil. (2) There are many details and methods incident to treating the

1: Osborn,C. - Op.Cit. - p. 134-136.
1: Ibid - p. 136-137
2: Ibid - p. 137

various products after distillation and the size and types of construction vary widely, but the fundamental principle of operation is the same in all skimming plants. (1)

2. Skimming and Cracking Plant

The addition of cracking equipment is the sole essential to change a skimming plant to this type. A cracking still is a boiling unit especially designed and constructed to permit the application of high temperature and pressure to its oil content. When gas or fuel oils are subjected to high temperature and pressure, they are converted into gas, gasoline, heavy fuel oil, tar, and coke.

The proportion of the first products mentioned and the presence of tar and coke depend upon the nature of the original charge, the type of process, the time cycle, and the manipulation of temperature and pressure. (2)

3. The Complete Plant

The addition of facilities for the manufacture of lubricants to the skimming and cracking plant completes the major functions of refining. Two products of the skimming plant are used in lubricant processing. After the gas oil has been removed from the crude charge, another fraction called "wax distillate" or "neutral distillate" is removed. It is called this because it contains much of the wax and also the principal content of available medium lubricating oil in the crude petroleum. (3)

In the case of crude oils suitable for the

1: Osborn,C. - Op.Cit. - p. 137
2: Ibid - p. 137-138
3: Ibid - p. 138

production of heavy residual oils of the steam-cylinder and bright-stock type, the residue is processed further for the manufacture of these prodacts. In the event the crude oil is not suitable for cylinder-stock production, the residues are either sold for fuel oil or utilized as cracking stock, or the operation is continued to dryness, or coke residue, for the purpose of obtained a larger yield of wax or neutral distillate by a partial cracking of the heavy fraction. (1)

Neutral oils are made from the wax distillate by various refining processes and bright-stock and steam cylinder lubricants from suitable residuums. The white paraffin wax of commerce is obtained as a by-product from the neutral or wax distillates, and petrolatum, the raw material from which vaselines and like products are made,is a by-product of the processing of the lubricating residue to bright-stock, blends of neutral oils and bright-stocks,etc. Thus the different types of motor and industrial lubricants are made. For special types of lubricating oils called "compounds", a small amount of vegetable or mineral oil is sometimes added. (2)

Crude oils vary widely in value as raw lubricant stock. In general, most of the lubricating oils are made from paraffin-bearing or intermediate crudes. The quality of the finished product depends much upon the care and skill put into its preparation. (3)

1: Osborn, C. - Op.Cit. - p. 138
2: Ibid - p. 138
3: Ibid - p. 139

production of heavy residual oils of the steam-cylinder and bright-stock type, the residue is processed further for the manufacture of these products. In the event the crude oil is not adaptable for cylinder-stock production, the residues are either sold for fuel oil or utilized in cracking stills, or the operation is continued to dryness, or coke formation, for the purpose of obtaining a larger yield of gas or heavy distillate by a partial overturn of the heavy fraction. (1)

Neutral oils are made from the wax distillate by various refining processes and bright-stock and steam cylinder lubricants from asphaltic residuums. The white paraffin wax of commerce is obtained as a by-product from the neutral or wax distillates, and petrolatum, the raw material from which vaselines and like products are made, is a by-product of the processing of the heavier residues, or bright-stock. Blends of neutral oils and bright-stock etc. thus the different types of motor and industrial lubricants are made. For special types of lubricating oils called "compounds", a small amount of vegetable or mineral oil is sometimes added. (2)

Crude oils vary widely in value as raw lubricant stock. In general, most of the lubricating oils are made from paraffin-base and intermediate crudes. The quality of the finished product depends much upon the care and skill put into its preparation. (3)

1. Osborn, W. - op.cit. - p. 133
2. Ibid - p. 130
3. Ibid - p. 132

Methods of Refining

1. Straight Run

In this method of refining, which has succeeded the batch system of operation, the crude charge goes through a continuous process by which it successively moves through a series of shell stills, each of which is heated to a higher temperature than its predecessor and vaporizes a different product. Modern practice is replacing the continuous shell operation with the pipe still, which has greater capacity and efficiency. (1)

The modern bubble tower and condensating equipment in the fractionating branch enable the refiner, by means of better temperature control and separation methods, to remove the vapors from most of the original crude charge in a continuous operation and to separate the condensing liquids into clean-cut finished refined products. This improvement of fractionating equipment has almost eliminated redistillation, increased the yields, especially of gasoline, and enabled the refiners to supply new products to the consumers. (2)

Thus, in the modern refinery, condensation is largely coupled with preheating by means of various types of heat exchanges whereby the heat released by cooling condensing products is transferred to the incoming charge of cold crude oil before it reaches the still. This practice results in a saving of the fuel used in the direct heating and reduces the volume of water necessary to lower the finished product to atmospheric temperature. (3)

1: Osborn, C. - Op.Cit. - p. 142
2: Ibid - p. 143
3: Ibid - p. 143

2. Cracking

This process includes the application of high temperatures and pressures by which the heavier constituents of crude oil, such as kerosene, gas oil, and fuel oil, are subjected to distillation in special stills. The treatment breaks down or "cracks" a certain proportion of these heavier forms of oil into gasoline, leaving a corresponding smaller residuum of heavy fuel oils of petroleum coke. The general adoption of this system would decrease to a marked extent the available supply of fuel oil and residue coke now available. The market prices of crude oil, fuel oil, and finished gasoline control both construction and operating practice. (1)

Manufacture of Natural-Gas Gasoline

Although the manufacture of natural-gas gasoline is intimately connected with the gas business, its use is almost universal in petroleum refining and much of it is made by the refining companies. The first commercial experiments for its production were made about 1910. It is one of the youngest branches of the oil and gas industries and has had a rapid growth. (2)

Casinghead gas, the raw material of the manufacture, taken from both oil and gas wells, was had since the beginning of the oil industry, but until the automobile increased the demand for the light fractions of crude oil, the potential gasoline in this gas was not extracted. The

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1: "American Petroleum, Supply and Demand", American Petroleum Institute - p. 50
2: Osborn, C. - Op.Cit. - p. 150

earliest plants used so-called "wet" gas from oil wells, as distinguished from "dry" gas yielded by gas-producing wells. The process consisted of compressing this gas and condensing a portion of the gasoline content by cooling. The product was known as "compression gasoline" or "natural-gas"gasoline. Improvements later permitted the use of so-called lean gases. The trade name "natural gasoline" has been adopted by the industry for the product yielded by all methods of manufacture. (1)

Oil-producing wells yield casinghead gas in quantities varying from a few hundred to millions of cubic feet per day. The gasoline content of this gas varies from a fraction of a gallon to 18 gallons per thousand cubic feet. The gasoline content of so-called dry gas is low with a variation of 0.1 to 0.6 of a gallon per thousand cubic feet.(2)

Natural-gas gasoline constitutes only a small part of the total motor-fuel supply. Much of the straight-run gasoline and a large part of the cracked gasoline could not meet the specifications of satisfactory motor fuel without the addition of natural-gas gasoline. All but a small portion of it is marketed to refineries and jobbers for blending with refinery gasoline. (3)

Natural Gas Industry

The importance of gas to the petroleum industry as a migratory agency in underground reservoirs, as an expulsive force that brings oil to the surface, and as a

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1: Osborn, C. - Op. Cit. - 151
2: Ibid - p. 151
3: Ibid - p. 155

source of valuable, high-gravity gasoline for blending purposes has been shown. Like petroleum, the natural-gas supply consists of underground reserves and current production,but unlike oil, aside from the gas in the transmission lines and a limited number of tanks, little of this commodity is held at the surface because of its extreme bulkiness. It is moved from the well to the consumer direct by pipeline. (1)

Many oil men are also gas producers. There are about 60,000 miles of trunk lines and an estimated investment in the natural gas industry is about 2 billion dollars.

After the gas has been produced either in company with oil or from dry-gas sands, and the desirable commercially recoverable gasoline has been removed, the gas that can be sold is turned into the lines of the transporters for industrial purposes. The practice of mixing natural and artificial gas is growing in several states, due to the decline in production of natural gas. (2)

Gas by-products include carbon black which is used by the motor-vehicle tire industry mostly to improve the quality of the rubber. It is also used in the manufacture of printer's ink, paint, polishes, phonograph records, and many other articles. (3)

Helium is another product of certain types of natural gas and is used much in the inflation of airships because of its safety. (4)

1: Osborn,C. - Op.Cit. - p. 227, 230.
2: Ibid - p. 227
3: Ibid - p. 236-237
4: Ibid - p. 237

Transportation

At the time of the start of oil production in Pennsylvania the only available transportation was furnished by tank wagons and flatboats. Pipelines were unknown and there were no railroads near Oil Creek where petroleum was first discovered. Later railroads were built to the oil fields and the construction of oil pipelines was started, which later developed into a great transportation system. (2)

The first pipeline was laid in 1865. It is of first importance in the transportation of crude oil in United States. The tanker ranks second and the railroad car ranks third. The present investment in transportation and storage facilities is estimated to be 2 billion dollars. (3)

A: Pipeline

> The crude oil pipeline facilities consist of several systems operated by different companies. Each system is made up of (a) gathering lines, (b) lateral and main trunk lines, and (c) trunk-line pumping stations and auxiliary equipment. The present crude-oil pipeline facilities are about one-third of America's railroad mileage. Over 17 million barrels of oil are required to fill these pipelines, and they actually transport a billion barrels annually. Texas ranks first as a source of shipments, Oklahoma second, and California third. (4) One-half of the total mileage in the United States is made up of trunk mains and the other half of gathering lines, or small feeders. The pipelines are similar to railroads, both having trunk lines, feeders, terminals, storage yards, switching systems, dispatches, and wire communication systems. (1)

2: Osborn, C. - Op. Cit. - p. 117
3: Ibid - p. 117
4: Ibid - p. 118
1: Ibid - p. 118, 120.

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2: Osborn, C. - Op. Cit. - p. 117
3: Ibid - p. 117
4: Ibid - p. 118
1: Ibid - p. 118, 120.

The pipe varies from 2 to 16 inches in diameter and is laid at varying depths, depending on the temperature of the region. Advantage is taken of the natural slope of the land where possible, and "booster" pumping stations are erected at appropriate distances to force the oil through the lines. Careful surveys are made in advance of construction to avoid grades and river crossings where possible. Tanks are built at pumping stations, and the oil is pumped from the tanks at one station to those of another, moving by degrees to its destination at an average rate of movement of 4 miles per hour. There is some intermixture of oils of different grades and prices in pipeline transportation. (2)

The major crude oil movement in United States is from the Mid-Continent region to the Great Lakes area and Atlantic Seaboard. There are two important routes. The other is via pipeline southward to the Gulf Coast and thence by tanks to North Atlantic States. (3)

Prior to the World War much refined petroleum was shipped abroad in barrels and tin containers and now most of the products are shipped in bulk by tanker. The World's tanker tonnage now amounts to about 10 per cent of the World's merchant tonnage. Great Britain leads the World in tanker tonnage and the United States is a close second. Together they own about three-fourths of the tonnage. Most of the tankers that comprise the oil fleet are owned by oil companies. Nearly all the tonnage is used in transoceanic and coastwise shipping, although a few tankers are operated on large lakes and inland seas. (1)

B. Tank-Car

Tank-cars are used chiefly for transporting refined oils from plants to marketing stations and large consumers. The cars range in capacity from 150 to 300 barrels

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2: Osborn,C. - Op.Cit. - p. 120
3: Ibid - p. 120-121
1: Ibid - p. 124-126

and most of them are owned and maintained by oil companies. (2)

C. Tank Trucks

Tank Trucks are used for the most part in the distribution of refined products to the service stations and ultimate consumer. Nearly all of the gasoline and lubricants are moved from bulk-distributing stations by motor truck to retail stations. The tank truck is of little consequence in crude-oil transportation. (3)

Storage Facilities

The storage of crude oil and refined products is intimately related to transportation. The four types of storage reservoirs are steel, concrete, wood, and earthen. Steel storage tanks constitute about 80 per cent of the total capacity. Storage capacity amounted to 816 million barrels in 1926, according to a survey made by U. S. Bureau of Mines. (4)

It is estimated that the national capacity amounts to about one billion barrels, 65 per cent of which is located at tank farms and most of the remainder at refineries. California and Texas are about tied for first place and Oklahoma follows in storage capacity. (5)

Costs

Oil production is unique in this respect that, while the initial expense in such an enterprise is great, the expense connected with prolonged exploitation is practically negligible (during time of natural flow). It takes a considerable outlay of money to finance the drilling

2: Osborn, C. - Op.Cit. - p. 128-129
3: Ibid - p. 129-130
4: Information Circular No. 6016, Dept. of Commerce, Bureau of Mines, January 1927, by G.R.Hopkins and A.B.Coons.
5: Ibid

of an oil well, as shown above, but once it is completed and oil is discovered in its natural association with gas, a kind nature furnishes the lifting power, delivering the crude product, sometimes in prodigious quantities, to the earth's surface. (1)

Oil producing costs vary from a few cents in the case of prolific, highly flush, flowing wells, to over $3.00 per barrel in pools where land expense was high or the drilling deep and costly, or where the yield is so low that lifting costs are high. The cost of lifting oil ranges from 20 to 90 per cent of total production expense. This great variation is caused by differences in the age, depth, and sand conditions of the wells. (2)

The main items in the cost of producing crude oil are: bonuses, rentals, geological expense, derricks, drilling, casing, pumping, auxiliary equipment, treating, depreciation, depletion, and general overhead. In some cases royalties must be added to expense. Taxes are an important factor in overhead expense. (3)

Detailed surface geological investigations, careful drill explorations, or geophysical surveys must be made in advance of drilling and make up a big part of total expense.

Drilling expense is one of the largest items in the cost of production and it varies with location and depth.

Depreciation of physical lease equipment is another high cost factor, especially where the oil contains sulphur or other corroding agents. (4)

1: Stocking,G.W. - Op.Cit. - p. 137
2: Osborn,C. - Op.Cit. - p. 100
3: Ibid - p. 100
4: Ibid - p. 100, 104

Investment and Returns

The total sum invested in the oil and natural-gas business by American companies is estimated to be about 16 billion dollars, showing that a large investment is in oil in this country. One-half is estimated invested in crude oil producing and the storage branch. (2)

The net return by the oil industry as a whole on its invested capital during the past 20 years has been small. Crude petroleum production is the least profitable division of the oil business. The refining and marketing profits have been only fair. Efficient refining is profitable over a period of years, but this branch of the industry, as a whole, has only earned average profits of 6 per cent. The pipeline branch of the industry has been more profitable than the producing or refining divisions, as evidenced from the reports filed by companies with the Interstate Commerce Commission. (3)

2: Osborn,C. - Op. Cit. - p. 10
3: Ibid - p. 11-14

CHAPTER III

DEMAND FOR AND UTILIZATION OF PETROLEUM PRODUCTS

Utilization

"Probably no other raw material enters so many fields of utilization as petroleum. Heat, light, power,and lubrication are its principal uses.

"Crude oil, subjected to a series of refining processes, in its initial distillation, releases the hydrocarbon gases. These are the source of fuel gas, used to heat refinery boilers; gas, or carbon black, used in making rubber tires, inks, and paints; and a series of alcohols used in hospitals and homes and as solvents for lacquers, soaps, and essential oils. From natural gas, which in nature is associated with crude oil, come liquefied gases, petroleum ether; natural gasoline, pentane, and numerous solvents.

"The first products of distillation are the white distillates, or naphthas and refined oils. The naphthas yield aviation gasoline and motor gasoline, commercial solvents, blending naphtha, varnish-makers' and painters' naphtha, and dyers' and cleaners' benzine. The refined oils include kerosene, illuminating oil, stove oil, tractor oil, signal oil and mineral seal oil. Produced at this stage of distillation also is furnace oil, the oil-heater fuel.

"The intermediate distillates are a source of gas oil and absorber oil. Gas oil is used by gas manufacturing plants in the carburetion of water gas, and is an important(1)

1: "Petroleum Facts and Figures" – p. 103

metallurgical fuel. Also it yields gasoline, by the "cracking" process, and Diesel fuel oil. Absorber oil enters into gasoline and benzol recovery.

"From the heavy distillates next derived come technical heavy oils, waxes, and lubricating oils. The white oils which lubricate bakers' and candymakers' machinery; the medicinal oils, used alone and in salves, creams, and ointments; and ink, saturating, emulsifying, electrical and flotation oils are among products obtained from technical heavy oils. The waxes are used in making candles, chewing gum, and candy; enter the laundry as detergents and iron waxes; and find wide use for sealing preserved fruits and vegetables. The lubricating oils are used wherever machinery is operated.

"The residues of distillation are put to various uses. The greases are lubricants, and by refining yield petroleum and petroleum jelly. Residual fuel oil is burned under the boilers of industrial plants, ships, and locomotives, and for making gasoline by "cracking" processes. Additional products of the residues are road oil, asphalt, pitches, and coke.

"From refinery sludges are made acid coke, a fuel; sulfonic acid, a saponification and de-emulsifying agent; oils and pitches; and the sulphuric acid used in fertilizer manufacture. (1)

1: "Petroleum Facts and Figures", Division of Public Relations, American Petroleum Institute - p. 103

Summary of Percentage Yields of Refined Products

The data in Table #1 shows the analysis of the past and present demand for oil. It presents the principal refined oil products produced from the crude oil run to the refining stills in this country in their approximate percentages. The products include gasoline, kerosene, lubricating oil, and gas and fuel oil.

The remarkable shifting of demand from one oil to another illustrates the revolution which the oil industry fortunately suffered at the hands of the automobile industry. The demand for kerosene, which required 58 per cent of the total quantity of crude oil refined in 1899, has so decreased with the competition of gas, electricity, and other forms of lighting, that it is now satisfied by only 5.6 per cent of the present total of crude oil refined. It will be also observed that 84 per cent of the total quantity of crude oil refined in 1933 was required by the demand for oil as a power-producer - i.e., 47.7 per cent as gasoline for the motor engine, and 36.4 per cent as fuel oil, either for steam raising or for the Diesel type of engine. The growth of the automobile and the airplane has been responsible for the tremendous increase in demand for gasoline from only 10 per cent in 1904 to 47.7 per cent in 1933. Another amazing increase is manifested by gas and fuel oil which made up 36.4 per cent of the crude oil refined in 1933, as compared with only 14 per cent in 1899. Lubricants have been fairly steady in demand over the last 10 years, comprising about 3 per cent of the total refined oils.

TABLE I

SUMMARY OF PERCENTAGE YIELDS OF MAJOR REFINED PRODUCTS BY YEARS (1)

(Computed on total crude runs to stills)

	Gasoline	Kerosene	Lubricants	Gas and Fuel Oil
1899	13.0%	58.0%	8.0%	14.0%
1904	10.0	48.0	10.0	13.0
1909	10.0	33.0	10.0	34.0
1914	18.0	24.0	6.0	46.0
1920	26.8	12.7	5.7	48.6
1925	35.1	8.1	4.2	49.3
1929	44.0	5.7	3.5	45.5
1930	46.6	5.3	3.7	40.2
1931	48.2	4.7	3.0	37.7
1932	48.8	5.3	2.7	35.9
1933	47.7	5.6	2.8	36.4

The four major refined oils - gasoline, kerosene, lubricating oil and gas and fuel oil - make up 92.5 per cent of the refined products which leave the refinery out of the 100% crude oil which is run to the refinery still. According to statistics for 1931, procured from the United States Bureau of Mines, the other 7.5% per cent is made up of the following products: Wax, about 3 per cent; Coke, about 1.2 per cent; Asphalt, about 1.8 per cent; and Road Oil, about 6 per cent.

1: Percentages for Years 1899-1914 were obtained from Davenport and Cooke, "The Oil Trusts and Anglo-American Relations", - p. 254. For years 1920-1931 percentages were obtained from U.S. Bureau of Mines circular "Crude Petroleum and Petroleum Products in 1931". Percentages for 1932 and 1933 were obtained from data supplied by U.S.Bureau of Mines, mimeographed sheets Nos.P-110 and P-115, "Annual Petroleum Statement".

Demand in United States

Gasoline:

The demand for gasoline has for a long time constituted about 35 to 40 per cent of the total consumption. While lubricating oils sell for a higher price per gallon than gasoline, the volume marketed is far less. Most of the gasoline is consumed in the internal-combustion engines of motor vehicles, - i.e., passenger cars and trucks. Of the total cost of motoring, gasoline amounts to about 10 per cent and lubricant expense is less than 2 per cent. (1)

In 1917 the domestic demand was about 150,000 barrels per day. It has since doubled and redoubled, and in late years the total demand, including exports, has been about 1,250,000 barrels per day. Exports amount to about 15 per cent of domestic consumption. (2)

Gasoline is used in large quantities by all types of motor vehicles - privately owned automobiles, taxicabs, buses, trucks, and motorcycles, and to some extent by tractors. (3)

Passenger cars - i.e., privately owned automobiles, hired cars, taxicabs and buses, have grown rapidly from a few in 1900 to about 23 million at the end of 1930. (4)

While the number of motor vehicles operated in this country is far less than that of passenger cars, yet it is a larger unit consumer of motor fuel and is therefore important to the oil man. The motor truck consumes two to four times

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1: Osborn, C. - Op.Cit. - p. 38
2: Ibid - p. 38
3: Ibid - p. 40
4: Ibid - p. 40

as much gasoline, depending upon size, as the average passenger car. Expansion was rapid from 1910 to 1926, but since the latter year the growth has been retarded. (1)

The motorcycle preceded both passenger car and truck. Ten years ago about 250,000 were in use, but there has been a marked decline, due to increased sale of low-priced automobiles. It is not an important factor in gasoline demand. Tractors are operated with both gasoline and kerosene, but the number in use is small compared to passenger cars and trucks. (2)

The adoption of the closed car, improvement of engine, improvement and extension of surfaced roads, the extensive adoption of bus transportation, the increase of trucks in competition with railroads - all these have caused an increase in the consumption of gasoline. (3)

The export trade has been an important and growing outlet for surplus gasoline in the United States for many years, but many oil men believe that this, as well as the foreign outlet for other refined oils, will soon be seriously curtailed by Anglo-Persian, Russian and other competition. Owing to the financial and industrial conditions abroad, the number of motor vehicles used in all foreign countries amounts to about one-fourth of the World's cars. (4)

The airplane is the most promising new means toward which oil men may look for increased gasoline outlet. Regular air-mail, passenger, and express services are now maintained

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1: Osborn, C. - Op. Cit. - p. 41
2: Ibid - p. 41
3: Ibid - p. 41-43
4: Ibid - p. 43

between many important cities. Since the mileage obtainable per gallon of fuel by the plane is lower than by the automobile, and the distance that can be reached in the same time far greater, the great possibilities for increased gasoline demand are plain. Statistics reveal nearly one million barrels are used annually. An average of about 7 miles per gallon or probably slightly less than one-half of that obtainable by the average motor car is secured by the plane. The mileage on Lindbergh's flight to Paris was about 9½ miles per gallon. (1)

Kerosene

Only about 5 per cent of the total demand for oil goes toward the domestic and export demand for kerosene. Though the consumption fluctuates slightly from year to year, there is no definite movement upward or downward. The export trade is a large factor, amounting in recent years to about 35 per cent of the total kerosene demand, but shows no tendency to increase. (2)

The main uses of kerosene are for house heating, lighting and tractor operation in country districts. Small quantities are consumed in a limited number of stationery engines and motorboats, and kerosene is also used to some extent for cooking. Kerosene has been practically eliminated for lighting purposes except in country districts. Only the growth of population, the use of tractors, and the export trade enable it to sustain its present position. It no

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1: Osborn,C. - Op.Cit. - p. 43-47
2: Ibid - p. 47

longer offers promise for any future enlarged outlet. (1)

Lubricants

The demand for domestic consumption and exportation amounts to about 3 per cent of the total demand for oil. While the demand is small in volume compared to gasoline and fuel oil, lubricants have no competitor in the reduction of friction. In steam engines they are used for cylinder lubrication and for cold bearings of great variety. For the internal combustion engine, a superior lubricant was made to withstand the high temperature between the cylinder walls and the pistons. (2)

The domestic and export demand for lubricating oils has nearly doubled in the past 10 years. The domestic demand has grown more rapidly than exports, but foreign shipments, including industrial lubricants, are large, representing about one-third of the total demand. It is estimated that the consumption by passenger cars is 1 gallon of lubricating oil to about 25 or 30 gallons of gasoline. The ratio for trucks and airplanes is about 1:20 gallons. (3)

Gas and Fuel Oil

Gas oil and other overhead distillates heavier than kerosene are used as internal-combustion fuel for light Diesel engines, for enriching artificial gas, and for heating buildings. When used for the latter purposes, they are called "furnace oils". Residual oils and some of the black crudes, high in asphalt, are consumed as fuel both under steam boilers and in large, heavy Diesel engines. The bulk of the supply

1: Osborn, C. - Op.Cit. - p. 47
2: Ibid - p. 47-48
3: Ibid - p. 48

consists of residual fuel oil. Gas oil is a light, straw-colored liquid, and heavy fuel oils are black and viscous. All gas and fuel oils may be included under the term "fuel oil" for convenience. The proportion of the total oil demand represented by fuel oil is 40 per cent. Since fuel oil has become a competitor of crude oil as raw material for gasoline manufacture, and since the consumption of fuel oil is about equal to that of gasoline, this heavy product occupies an important place in the economics of oil. (1)

It is sometimes stated that increases in fuel oil occur only when the price is low, and its chief competitor, coal, is expensive. It is true that low prices stimulate the consumption of fuel oil more than gasoline, but facts do not indicate that low prices are necessary before the fuel oil demand will grow, for there has been a healthy increase in fuel oil demand and the largest gain occurred when the price was highest. Oil is simply a superior fuel and consumers are being gradually educated to its advantage as a source of heat and power. In 1919 the demand was about one-half million barrels per day. During the following few years it doubled and since then has been in the increase. (2)

A: The Shipping industry is the largest individual consumer. Fuel oil attains a high degree of efficiency in marine transportation. The motorship, powered by Diesel engines fed with fuel oil by compressed air, has become an important factor in marine transportation. The important naval vessels of the World are motorships or oil burners. Speed, cleanliness, and flexibility and the time and space saved in bunkering are the well-known advantages of the motorship over the coal burner. Because of these

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1: Osborn,C. - Op.Cit. - p. 49
2: Ibid - p. 51-52

superiorities, nearly one-half of the world tonnage recently launched was powered with Diesel engines. (1)

Steamships use large quantities of fuel oil under their boilers. In ten years the tonnage of oil-burning ships has more than doubled. Some have been built to burn oil, and others have been converted from coal burners. The advantages mentioned above for motorships have been the factors that controlled the installation of the fuel-oil burners or the conversion from coal. Approximately 38 per cent of the World's shipping consumes oil as motor or boiler fuel, and as new tonnage is launched, a large part of it is designed to use fuel oil. (2)

B: Railroads rank second as fuel-oil consumers. Most of the oil so consumed is used by locomotives operated in the southwestern and northwestern states, where good coal can only be obtained by long hauls and fuel oil supplies are abundant. Oil supplies about 10 per cent of the fuel requirements of American railroads. The past 5 years have shown little change in the demand due to the general improvement in railroad-fuel efficiency. The ton mileage per unit of fuel oil used has been increased. (3)

C: The producing companies, pipelines, and refineries in the petroleum industry rank third among the consumers of fuel oil; thus convinced of the merits of its own product. The refineries are the greatest users, approximately 40 per cent of the heat used in firing stills being obtained by them from oil. The use of it is not growing in refineries, due to efficiency and economy in heat generation and the greater use of gas. The use of fuel oil in the pumping stations of pipeline companies, though small, is increasing. (4)

D: Gas and electric power and light plants rank fourth. About two-thirds of the total quantity used is employed in water-gas carburetion and oil-gas production, but the data show that the earth used to enrich water gas, representing three-fourths of the consumption by the gas-manufacturing industry, has been steadily declining for several years. The

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1: Osborn,C. - Op, Cit. - p. 52, 54
2: Ibid - p. 54
3: Ibid - p. 54
4: Ibid - p. 55

superiorities, nearly one-half of the world tonnage recently launched are powered with diesel engines. (1)

Steamships use large quantities of fuel oil under their boilers. In ten years the tonnage of oil-burning ships has more than doubled. Some have been built to burn oil, and others have been converted from coal burners. The advantages mentioned above for motorships have been the factors that controlled the installation of the fuel-oil burners or the conversion from coal. Approximately 30 per cent of the Pacific shipping consumes oil as motor or boiler fuel, and as new tonnage is launched, a large part of it is designed to use fuel oil. (2)

B: Railroads rank second as fuel-oil consumers. Most of the oil so consumed is used by locomotives operated in the southwestern and northwestern states, where good coal can only be obtained by long hauls and fuel oil supplies are abundant. Oil supplies about 10 per cent of the fuel requirements of American railroads. The past 5 years have shown little change in the demand due to the general improvement in railroad-fuel efficiency. The ton mileage per unit of fuel oil used has been increased. (3)

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1: Osborn, C. - Op. cit. - p. 52, 54
2: Ibid - p. 56
3: Ibid - p. 58
4: Ibid - p. 59

water gas has been displaced by coal gas, and cokeoven, natural, and refinery-still gases. The quantity of fuel oil used in oil-gas production is likewise decreasing. The electric public utility power and light plants use only a small quantity of of fuel oil. (1)

E: Sources of Heat for Buildings: One of the most rapidly growing and promising outlets for fuel oil is for the heating business and public buildings and residences. Although the consumption is less than 100,000 barrels per day, there has been an increase of nearly 30 per cent during the last 3 years. Domestic consumption is increasing more rapidly than commercial use . The potential market is very large indeed and very promising. (2)

F: Other Industrial Users: The other uses for fuel oil in the United States are divided among a number of industries that burn it under the boilers of steam plants, consume it in stationary internal combustion engines, and otherwise apply it for specialized purposes. (3)

Among these industries are the iron and steel producers, smelters and mines, and the food industries, which are the largest of miscellaneous users. The logging and lumbering industry, textile producers, ceramic industries, automobile manufacturers, and paper and wood-pulp producers are limited individual users. The chemical and allied industries appear to be increasing in using fuel oil and the cement and lime plants decreasing. (4)

It is well known that fuel oil possesses superior characteristics over most other fuels and in many places it is burned in competition with coal, solely on the basis of comparative cost and heating value. Its advantages of ease of storing, handling, and thermal control are better than any other fuel, and the consumption could be tremendously expanded at the expense of coal, if a sufficiently low price was promised. (5)

1: Osborn,C. - Op.Cit. - p. 55-56
2: Ibid - p. 56-57
3: Ibid - p. 57
4: Ibid - p. 57
5: Ibid - p. 58

Export Trade: About 10 per cent of the fuel delivered for consumption consists of shipments to foreign countries, most of which originate in California and the Gulf Coast. During the past 10 years the quantity exported has increased about 100 per cent. (2)

Wax, Asphalt, and Coke

Wax, produced in both crystalline and amorphous forms, is largely used for the manufacture of candles, sealing, and preserving materials, and medical dressings. Small quantities are used in the engraving and other industries. Wax consumption has shown but little change in many years. Exports are greater than domestic demand. (3)

Asphalt, manufactured into solid, semi-solid, and liquid products, is sold principally for paving, roofing, and waterproofing purposes. It has increased nearly 150 per cent since 1920. While petroleum asphalt has many competitors, it is, because of its cleanliness, resiliency, and durability, an excellent paving material. It may be expected to increase due to pressing demands by motorists for better roads. (4)

Petroleum Coke, especially the better grades, because of its purity, is consumed by the metallurgical and electrical industries, and the poorer varieties are used for domestic and industrial fuel. During the past few years the practice of pulverizing coke and using it industrially in the fashion of powdered coal has grown. The use of petroleum coke has increased about 200 per cent since 1918

2: Osborn,C. - Op.Cit. - p. 59
3: Ibid - p. 59
4: Ibid - p. 59-60

and is promising in future demand. (1)

The above products, taken collectively, amount to about 3.5 per cent or slightly more than the consumption of lubricants.

The statistics of the domestic consumption and export trade in oil are not complete without the inclusion of shipments of crude petroleum to foreign countries. This trade has shown substantial growth, although small. The bulk of the oil is sent to Canada. (2)

Demand in Foreign Countries

The consumption of oil in all foreign countries amounts to about one-third of the World's demand. The growth has not been as rapid as in this country, but it is steady.(3)

The smaller demand abroad is not due to lack of adequate underground reserves for there is much evidence that the amount of oil in some of these countries equals or exceeds the quantity in our own. But many of the proved pools are far removed from the centers of consumption, and it has been found economically inexpedient to develop them and construct the necessary long pipelines and refineries to supply oil in large quantities. The laws and political conditions in some countries are also unfavorable to the competition which has brought on over-production and low prices in this country. The result is that the petroleum fields of foreign countries are not so intensively developed and much American oil has been shipped to meet this deficiency. (4)

1: Osborn,C. - Op.Cit. - p. 60
2: Ibid - p. 60
3: Ibid - p. 288
4: Ibid - p. 288

The demand for oil in foreign countries has been growing nearly twice as rapidly in recent years as in the United States, with the probability of continued expansion.(1)

Economic conditions also limit the use of oil; for example, the number of motor vehicles used in all foreign countries amounts to about one-fourth of the World's cars. Nevertheless, foreign countries offer a large potential market to the motor-car manufacturers and registration data shows a gain of 60 per cent since 1924 compared to a gain of 20 per cent in the United States. The present ratio is about one car to every family in the United States to about one car to every 300 persons throughout the rest of the world. (2)

1: Osborn,C. - Op.Cit. - p. 290
2: Ibid - p. 290

SUPPLY AND DEMAND OF ALL OILS 1920-1933
(Including wax, coke, and asphalt in thousands of barrels of 42 U.S.Gallon)

	1920	1925	1929	1930	1931	1932	1933
NEW SUPPLY:							
Domestic Production:							
Crude Petroleum	442,929	763,743	1,007,323	898,011	851,081	785,159	898,874
Natural Gasoline ...	9,161	26,307	52,271	52,631	43,617	36,281	33,610
Benzol	1,771	1,857	3,055	2,689	1,826	1,031	1,473
Total Production ..	453,861	791.907	1,062,649	953,331	896,524	822,471	933,957
Imports:							
Crude Petroleum	106,175	61,824	78,933	62,129	47,250	44,682	32,773
Refined Products ...	2,647	16,376	29,777	43,489	38,837	29,812	13,498
Total New Supply, all oils...	562,683	870,107	1,171,359	1058,949	982,611	896,965	980,228
Increase in Stocks, all oils...	27,303	29,291	68,156	24,000	44,989	41,792	8,256
DEMAND:							
Total Demand	535,380	840,816	1,103,203	1082,949	1,027,600	938,757	971,972
Exports:							
Crude Petroleum	9,295	13,337	26,401	23,705	25,535	27,393	36,703
Refined Products ...	70,281	100,497	136,719	132,794	98,859	75,882	69,822
Domestic Demand:							
Motor Fuel	102,937	226,329	375,999	394,800	403,418	373,900	378,143
Kerosene	33,082	39,969	36,032	34,736	31,296	33,221	38,440
Gas Oil and Fuel Oil	185,972	*	*	*	334,668	308.157	321.395
Lubricants	14,742	20,581	23,609	21,589	20,068	16,614	17,006
Wax	200,651	244,301	274,572	242,109	276,457	264,463	1,260
Coke	-------	-------	-------	-------	7,820	9,592	10,091
Asphalt	-------	-------	-------	-------	14,729	12,652	11,260
Road Oil	-------	-------	-------	-------	5,078	6,648	6,095
Still Gas(production)	-------	-------	-------	-------	38,630	40,905	45,212
Miscellaneous	-------	-------	-------	-------	3,906	1,978	1,443
Losses & Crude as fuel	-------	-------	-------	-------	42,605	30,870	35,042
Total Domestic Demand	455,804	726,982	940,083	926,450	903,206	835,482	865,447
STOCKS:							
Crude Petroleum	149,448	431,646	535,514	411,882	370,919	339,715	355,394
Natural Gasoline	*	326	2,291	3,100	2,825	3,203	3,186
Refined Products	60,397	120,492	151,692	251,680	258,879	257,188	242.873
Total Stocks,all oils	209,845	552,464	689,497	666,662	632,623	600,106	601,453

Source: U.S.Bureau of Mines

TABLE 2

CHAPTER IV

WASTE AND CONSERVATION OF PETROLEUM AND GAS

Physical Waste

Oil is not wastefully handled on leases after it reaches the surface, considering its natural volatility, fluidity, and mobility. Some oil has undoubtedly been lost at unavoidable times, especially before new wells can be placed under control, but compared to the total volume, the loss is small. Producers generally exercise great care to save all produced oil. (1)

There is a small loss in pipeline transportation and storage of crude petroleum, due to evaporation of the light fractions and leakage from lines and tanks. The engineering profession is fast solving some of these problems, e.g., by use of the floating roof and the welded joint in place of the screw coupling. The concrete container is subject to settling and cracking, and some oil is lost from these tanks and from earthen reservoirs by seepage and evaporation. Now 80 per cent of crude oil tankage consists of steel and only 20 per cent earthen and concrete. There is no available data for showing the amount of petroleum lost in crude-oil transportation and storage. (2)

The difference between the marketable products secured from the refineries and the qualtity of petroleum charged to the stills by the whole industry is about 4 per cent. A great deal of gasoline is lost by evaporation from

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1: Osborn,C. - "Oil Economics" - p. 299
2: Ibid - p. 299

refined tankage, but much is being accomplished in the reduction of these losses by means of breathing devices, cooling equipment, etc. This product is lost also by evaporation in tank-car transportation, but large savings are effected by the use of pipelines. (1)

A serious loss of gas has been common throughout the entire history of the oil and gas industries. As oil and gas occur together in the subsurface reservoirs and oil is more valuable than gas, there is naturally more gas produced at times than demand will absorb, and the surplus cannot be sold. Although the gas-oil ratio is high many times, the oil men who drill the well naturally want to recover as much of the valuable petroleum as possible,and huge volumes of gas are wasted in this way. Most of the gas is now treated for the removal of its gasoline content. Sometimes, if a well yields no oil, the natural gas has been wasted. (2)

Natural gas, on account of its large volume even under pressure, requires lines of larger diameter than oil, and the losses due to leakage in transportation are sometimes great and difficult to detect. Expansion and contraction are great and much gas can escape in a short time from small openings in the lines. (3)

Economic Waste

Economic waste is the underground loss of oil and gas, and the more or less intangible increase in cost and prices or the escape of savings and profits. The losses are caused by unnecessary and unwise drilling and producing

1: Osborn,C. - Op. Cit. - p. 300
2: Ibid - p. 300-301
3: Ibid - p. 301

practice, overproduction, waste of gas energy, and duplication of transportation, refining, and marketing activities. The above facts are controversial and difficult to analyze.(1)

It is believed that the fundamental cause of the alleged economic losses is injudicious drilling and lifting practice and that supply should be restricted by more economic well-spacing and by better methods and control of production. The result might be that oil reserves would be conserved, gas would be more fully utilized as a natural lifting agent, and costs would be decreased and profits decreased. Many oil men agree that overproduction is an outstanding evil of the industry and should be curtailed.(2)

Facts indicate that there are wastes which can be reduced and modifications in practice that the industry can make voluntarily which will lower costs. (3)

Conservation

A detailed definition of oil and gas conservation is difficult, due to the various schools of thought, but in general, conservation means the wise use of natural resources.(4)

There are, in general, three groups of conservationists. One group believes that the oil supply of the United States will be soon exhausted and that its exportation should be stopped and the demand restricted to gasoline and lubricating oils due to the inability of oil sources to be quantitatively measured like coal. This would result in a disruption of manufacturing practice, deprive the fuel

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1: Osborn,C. - Op. Cit. - p. 301-302
2: Ibid - p. 301-302
3: Ibid - p. 302
4: Ibid - p. 297

consumer of the oil he can use at competitive price, and emasculate a foreign investment by American companies amounting to nearly $1\frac{1}{2}$ billion dollars. (1)

A second group believes the petroleum reserve is practically inexhaustible and think that oil should be produced as rapidly as possible, and since petroleum is superior to coal, it should be used to displace coal whenever it can be done. (2)

The third group takes a middle course and believes that the reserves are large, but fixed, and that conservation based on price and sane competition is important and that efficient methods of production which will reduce costs and result in the largest possible yields should be employed and finally that petroleum should be refined and consumed under conditions which will yield maximum utility. This belief is the most practical and is supported by law and economic principle. (3)

Government Regulation

1: Federal Oil Conservation Board:

> In 1924 President Calvin Coolidge recognized the fact of alleged economic waste in the oil industry by the appointment of a Federal Oil Conservation Board. This Board consists of three members of the Cabinet aided by technical advisers and has been studying the oil situation for several years. While it has no legal authority over the industry, it makes reports to the President on national petroleum conditions and acts in an advisory capacity to the oil men. (4)

1: Osborn, C. - Op.Cit. - p. 298
2: Ibid - p. 298
3: Ibid - p. 298
4: Ibid - p. 304

It is thought that the oil industry should be regulated by the Government as the railroads are regulated by the Interstate Commerce Commission. Theoretically, many beneficial policies could be effected by unprejudiced centralized management - namely, spacing of wells according to advice of engineers in charge; developing of pools in an orderly manner; making and preserving drilling and production records for use by all; balancing of supply and demand; eliminating excessive refining and marketing facilities; and research. (1)

There are many practical reasons against Government regulation - namely, many new fields are needed to supplement declining pools, and the cost of finding is so high that the wildcatter must not be discouraged by restrictions which would remove his chance for reward; large supervisory organizations would be required that might be influenced by politics, and too many decisions would be put in the hands of boards and committees, and the oil industry is not yet as mature as were the railroads when the Government stepped in with its regulations. (2)

2: National Industrial Recovery Act - Oil Code:

A major development in oil industry stabilization occurred during 1933, when the transition from State to Federal control of many of those functions that Government is presumed to exercise was effected. For several years stabilization of the oil industry has been considered a function of Government. Prior to 1933, the control of oil field development and production had been left exclusively to the State governments and was generally regarded by oil lawyers as coming within the exclusive Constitutional authority of the State to regulate as opposed to Federal legislation. The states had failed in their effort, however, for several reasons. Superficiality of attempted remedies, conflict with Federal Constitutional provision, and difficulty of co-ordinating programs with each other, all combined to defeat

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1: Osborn,C. - Op.Cit. - p. 318
2: Ibid - p. 318-319

> the efforts of several oil-producing states so that by May 1933 the oil industry had reached a new economic low in its recent history. (1)
>
> A procedure was evolved under authority of the National Industrial Recovery Act by means of which the Federal Government could exercise the necessary control and thereby bring about a carefully planned co-ordinated effort comprehending the States and the Federal Government, acting in conjunction with representatives of the oil industry. (2)
>
> An Oil Code or agreement was formulated and adopted which set out details, by which the production and sale of oil and its products were to be regulated and controlled, and centred authority in the President of the United States for administration of the Code with the advice and assistance of a committee nominated by the industry. The President, in turn, named the Secretary of the Interior as Oil Administrator, and the latter set up the Petroleum Administration Board to assist in the exercise of his duties as they relate to the oil industry. (3)

On August 19, 1933, President Roosevelt signed the Oil Code to be effective September 2, 1933. This was done to accomplish and effectuate the policies set forth in the National Industrial Recovery Act which would result in a code of fair competition to govern the whole petroleum industry.

The purposes of this code were as follows:

1: To meet the emergency in the petroleum industry.

2: To increase employment, establish fair and adequate wages, enlarge the purchasing power of persons related to this industry, and improve standards of labor.

1: Oliver, Earl - "Stabilization in the Oil Industry" -p.19 Mining and Metallurgy, January 1934.
2: Ibid - p. 19-20
3: Ibid - p. 20

3: To conserve the Nation's petroleum resources and to prevent physical and economic wastes which demoralize the national market to the detriment of consumers and producers, and to restrain and avoid recurring abuses in the production, transportation and marketing of petroleum and its products which directly obstruct the free flow of interstate and foreign commerce by causing abnormal and disturbing temporary fluctuations in the supply of petroleum or its products that are not responsive to actual demand and prices and disrupt the normal flow of interstate commerce in petroleum and its products.

4: To prevent the growth of monopoly resulting from unfair competitive practices.

5: To protect the Nation from an unnecessarily wasteful depletion of this natural resource essential for the national defense and safety and the continued functioning of the Nation's transportation facilities that are dependent for operation on an adequate and economic supply of petroleum and its products. (1)

The administrative machinery for the effectuation of this code consists of:

1: The Planning and Co-ordination Committee, representing the petroleum industry and the National Recovery Administration.

2: A Federal Agency designated by the President.

The Planning and Co-Ordination Committee consists of 15 members, three of whom (without vote) shall be representatives of the National Recovery Administration and appointed by the President, and twelve of whom shall be representatives of the petroleum industry.

The Planning and Co-Ordination Committee co-operates with the petroleum administrator, who is the Secretary of the Interior, as a planning and fair practice agency for the petroleum industry.

1: National Petroleum News, "Oil Code as Amended September 13", September 20, 1933, - p. 25-32

The Federal Agency designated by the President makes such estimates of petroleum requirements and such recommendations, allocations and inventories as may be required for the effectuation of this code. They are also empowered to call upon the industry for all necessary statistical and other reports.

The President may also limit imports of crude petroleum and petroleum products, limit withdrawals of crude oil from storage, cut down production of the wells by setting up quotas in the states, and prescribe a base price for gasoline for a certain length of time.

Wildcatting is not forbidden, as this practice aids in the future maintenance of the petroleum supply.

The Federal Agency has the power to divide the country into eight refining districts and to suggest a proper relationship between inventories of gasoline and the sales thereof for each district. (1)

Maximum hours and minimum wages for all branches of the industry are defined and set forth in the code. Furthermore, a schedule of equipment prices to be used as a basis of purchase or sale between oil companies and a schedule of maximum credit terms are also set forth in the code.

The transportation rates and practices are to be investigated from time to time by a sub-committee of the Planning and Co-Ordinating Committee and appropriate action to be undertaken is recommended to the President.

1: National Petroleum News - Op. Cit. - p. 25-32

Provisions relating to the transactions of refiners, distributors, jobbers, and wholesalers in detail are set forth in the marketing section of the code. (1)

Importation

Another suggestion that has been put forward by interested parties is that America might conserve her oil supplies by importing larger quantities of foreign petroleum, because whatever may be the oil reserve of the United States, it is fixed. If demand continues to grow, it is well known that, in case of partial shortage, additional foreign oil could be more cheaply imported than substitutes could be manufactured from coal or oil shales. (2)

Facts show that production and consumption in the United States are much larger than in all the rest of the World, but that our underground oil supply is small compared to the reserves of foreign countries estimated on the basis of known geology. Twelve years ago it was stated in the United States Senate that this country contained one-sixth of the reserves but produced three-fourths of the World's consumption. Although not quite so true today, the unfavorable relationship still prevails. (3)

It appears that foreign countries, though as a whole, possessing immense quantities of oil, are attempting to conserve their underground supplies and largely operating their internal combustion motors, burners, and machinery with American oil. While this relationship is striking from a commercial viewpoint, when looked upon from the angle of

1: National Petroleum News, "Oil Code as Amended September 13", September 20, 1933, - p. 25-32
2: Osborn,C. - Op.Cit. - p. 319
3: Ibid - p. 320

national security with the knowledge in mind that oil is a vital necessity in time of war, many people think it is doubly significant and that the problem of conservation by importation is broadened to include questions concerning the political and commercial control of the World's resources.(1)

American companies fortunately control most of the domestic production and reserves, and are large holders of producing and promising leases and concessions in some of the foreign countries of the Western Hemisphere - namely, Venezuela, Mexico, and Colombia. All the oil reserves in this country could be mobilized for national defense and could be imported from neutral companies. (2)

Struggle for Reserves by Standard Oil and Royal-Dutch-Shell

Prior to the twentieth century the Standard Oil group dominated the foreign oil situation, but today conditions have been materially changed by the aggression of foreign companies. The Dutch Shell Syndicate, aided by the British Government, has become a formidable competitor whose operations cover almost the entire civilized World exclusive of Russia. American companies lead in the productive fields of Colombia, Mexico, Venezuela, and Canada, but are entirely or largely barred from Russia, the Dutch East Indies, Persia, India, Egypt, and many other parts of the British Empire and its mandates, and produce oil in small quantities in Trinidad, Poland, and Roumania. (3)

The producing fields become the depleted areas of

1: Osborn,C. - Op.Cit. - p. 320
2: Ibid - p. 320
3: Ibid - p. 321

tomorrow, and the control of production does not give a true picture of our interest in the foreign reserves. Before the World War the open door policy prevailed throughout most of the world, and there was little need for concern. During this great conflict, Great Britain, then the owner of only a small part of the reserves, learned the value of oil, especially to her naval fleet, and established a policy that within a comparatively few years has placed her in political and/or commercial control of over one-half of the World's underground oil. In many of her domains the door has been closed to American companies and conditions have thus been created that have made oil an outstanding subject of international diplomacy, which, according to some authorities, may lead to a breach in Anglo-American harmony. (1)

The two following statements, one by Sir Edward Mackay Edgar, British petroleum banker in 1919, illustrating the British policy, and the other by Mr. Pretyman M.P. in the London "TIMES", shows how Great Britain has advanced in the petroleum industry: (2)

Sir Edgar's Statement

"America has recklessly and in 60 years run through a legacy that, properly conserved, should have lasted her for at least a century and a half. Just when Americans have become accustomed to use twenty times as much oil per head as is used in Great Britain; just when invention has indefinitely the need for oil in industry; just when it has grown to be as common and as true a saying that "oil is king"

1: Osborn,C. - Op.Cit. - p. 321
2: Ibid - p. 321-322

as it was 20 years ago that steel was king; just when the point has been reached where oil controls money instead of money controlling oil -- the United States finds her chief source of domestic supply beginning to dry up and a time approaching when, instead of ruling the oil market of the world, she will have to compete with other countries for her share of the crude product -- The British position is impregnable. All of the known oil fields, outside of the United States itself, are in British hands or under British management or control, or financed by British capital."

Mr. Pretyman's Statement on May 1919:

"When the war came, the position was that the British Government, with its vast interests in the whole world, controlled about two per cent of the World's petroleum supplies -- now he thought that when adjustments were completed the British Empire would not be very far from controlling one-half of the available supplies of petroleum in the World." (1)

The first statement is exaggerated, but the last has proven to be true.

Stung by these facts and statements, which were published throughout the world, and by the future possibility of the need for foreign oil, both the State Department and the oil companies of the United States set to work. As a result, our reserves in the Latin American countries have been increased; foreign countries have been barred from acquiring ownership of oil rights under unleased land in this country unless our companies are accorded the right to

1: Denny,L. - "We Fight for Oil" - p. 30

lease in the countries to which these foreign groups owe allegiance; and Great Britain by diplomatic correspondence has been persuaded to open her doors to American oil companies in some of her domains where they had been closed. (1)

Political Importance

Oil fields may be divided into two main classes, according to their location within or outside of the territory of the controlling interests. Most of the oil fields in the United States are being exploited by American capital, the Royal-Dutch-Shell being the only important foreign company drawing on the crude oil supplies and engaged in important marketing operations in this country. At present Russian oil resources are being developed exclusively by the Russian Government through the oil trust, the Soyusneft. Apart from these two important exceptions, most oil fields of the world, including even the European fields of Rumania and Poland (Galicia), are being exploited by foreign capital interests, mainly, American, British, Dutch, and French. (2)

The political fight for oil began about 1911-1912. Signs of a struggle increased during the World War, but it only developed in the years after the war. The struggle is being fought out today, and will be carried on tomorrow as fiercely as ever. (3)

The cause of all this is the introduction of oil as fuel for ships in practically every fleet in the world. Up to 1910 the Governments of the World could look on calmly while their citizens made increasing use of rock oil, first as an illuminant in their lamps, and then as a source of

1: Osborn,C. - Op.Cit. - p. 322
2: "World Resources and Industries", by Erick W. Zimmermann, p. 496 - Harper & Bros.,Publishers, N.Y. & London, 1933, - 841 pages.
3: Mohr,A. - "The Oil War" - p. 34

power in their vehicles and factories. All this was economic matter and of no interest to the political powers. The State only intervened with legislation which was intended to check the extensive formation of tourists. All this was purely internal matter and had no connection with international relations between countries. (1)

This attitude only changed when the problem presented itself as to who should control the world's oil fields and it became vitally important for the future development of the world's navies. Thencefrom, oil became a political factor of great international importance. (2)

This letter in itself proved a warning and an exhortation to Clemenceau to use his opportunities to secure as much as possible of the valuable oil from the Near East for France. (3)

This "oil war", as it is called, is being waged with much secrecy for it is doubtful if any chapter in contemporary history can show so many biased statements and willfully falsified documents of a more or less "official character" as the story of the oil war. The governments of the various countries seldom appear openly in the field, but frequently act under cover of private companies, whose capital and management are more or less controlled by them. Thus the companies, and not the countries themselves, are the official combatants. (4)

1: Mohr,A. - Op.Cit. - p. 34-35
2: Ibid - p. 35
3: Ibid - p. 36
4: Ibid - p. 36-37

Importance of Transportation by Water

With the exception of the United States and Russia none of the leading world powers have within their boundaries the oil supplies needed to meet present peace-time requirements and,even in the case of the United States, it is admitted by competent observers that the known oil reserves within the country are adequate to meet demands for more than a comparatively few years. It follows,therefore, that the transportation of petroleum - almost entirely by tank steamers - from foreign fields to the main consuming centres is one of the most important factors affecting the present and future development of the oil industry. (1)

The wrold-wide distribution of petroleum is affected by numerous factors of which international politics is not the least important. The assurance of an ample supply of petroleum - one of the most essential munitions of war - is of paramount importance,particularly to those countries subjected to the rivalries of powerful neighbors, and paralleling the importance of the control of an ample supply is that of its safe transportation from the fields to the consuming centres. To illustrate: France is dependent almost entirely on foreign sources for its petroleum requirements, estimated at close to 100,000 barrels daily, and in order to control such a supply, it acquired,after the World War, an interest in Iraq oil fields. It has lately undertaken the construction of a pipeline from these fields to the Mediterranean seaboard in Syria with the expectation that late in 1934 these fields will supply between 30 and

1: Garfias,V.R. -"Tanker Rates and Canal Tolls Important Factors in Determining Markets of Foreign Oil" OIL AND GAS JOURNAL,February 22, 1934.

40 per cent of the country's requirements. It should be noted, however, that the availability of the supply is entirely dependent on the safe operation in the Mediterranean at all times of an adequate fleet of tank steamers. Thus, in order to transport 40,000 barrels daily, it will be necessary for one 10,000-ton tanker to leave Tripoli, the Syrian port, say for Marseille, every other day throughout the year, while to meet the entire present peace requirements of France from the Iraq fields, a fleet of some 30 such tankers must be kept in continuous operation between Tripoli and Marseille.

There are now in operation close to 1,680 tanker steamers, more than half of which will load on an average considerably less than 50,000 barrels. The tank steamers commonly employed in the international oil trade, on the other hand, have carrying capacities in excess of 70,000 barrels. The number of such tankers, which aggregate 625, and their average individual carrying capacities follow :

Number of Tankers	Carrying Capacity in U. S. Barrels
200	75,000
165	85,000
80	95,000
180	over 100,000

The cost of marine transportation varies directly with the distance between terminal harbors and it thus follows that the use of canals which shorten such distance is economical whenever the canal tolls represent a saving over the added cost of the longer route, which eliminates the use

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Garfias,V.R. - Op.Cit. - p. 11

of the canal.

Reserves in the United States

In 1921 the United States Geological Survey, in co-operation with the American Association of Petroleum Geologists, made an exhaustive, painstaking estimate of all producing, probable, and possible oil territory. The conclusion was reached that the underground reserves recoverable by existing methods of drilling and producing at that time amounted to about 9 billion barrels. Between 1920 and 1933 the United States produced nearly 10 billion barrels of oil. Deeper drilling and better finding and producing methods were used during these 13 years than in earlier years. (1)

Experience seems to show that no satisfying estimate of the underground supply in barrels can be made. The commercial reserves of producing wells can be computed by engineering methods, and the economically recoverable oil in proved undeveloped areas can be calculated with reasonable accuracy. The engineer can also estimate how much additional oil can be recovered from wells at high costs after they are exhausted by ordinary methods of flowing and pumping, and also the amount of petroleum left in the producing horizons after the oil recoverable by existing commercial methods has been fully produced. (2)

The additional oil that may exist in the vast untested areas of the United States cannot be estimated. All the geologist can do is point out the areas, but they must be

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1: Osborn, C. - Op.Cit. - p. 88-89
2: Ibid - p. 90

drilled to determine whether or not, and in what quantities, they contain oil. (1)

According to estimate, the producing areas in 1925 amounted to about 2 million acres, credited with a reserve of approximately $3\frac{1}{4}$ billion barrels. That area of the proved, undeveloped pools was about 1 million acres, estimated to yield nearly $1\frac{1}{2}$ billion barrels. The total proved commercial reserves, with the exceptions noted, amounted to a little over $4\frac{1}{2}$ billion barrels. It was also stated that a little over $1\frac{1}{2}$ billion barrels of additional oil could be profitably recovered by ordinary methods of flowing and pumping at higher prices than those paid in 1925, thus bringing the total to a little over $5\frac{1}{4}$ billion barrels. (2)

It is well known by men who have compared the original content of oil sands with the yields that the larger proportion of the petroleum remains in the producing horizons after flowing and pumping cease. According to some, 80 per cent remains. When need and the price are right, much of this oil could be recovered perhaps by flooding or restoration of pressure with gas or air, by sinking shafts and cutting galleries, or by mining the oil sands. The committee estimated that about 26 billion barrels would remain in the sands of the producing and proved undeveloped fields of this country after common methods of flowing and pumping failed to yield further oil. Since over 15 billion barrels of oil have been produced in this country, this estimate appears conservative. (3)

1: Osborn, C. - Op. Cit. - p. 90
2: Ibid - p. 91
3: Ibid - p. 92

Vast Untested Possible Areas

Only a small part of the probable and possible oil territory of this country has been tested to conclusive depths and,without the information given by deep tests,little can be known about sub-surface geology. Surface evidence and fragmentary sub-surface data indicate that there are vast untested areas which may contain petroleum. (1)

The report of the Committee of the American Petroleum Institute states in part: (2)

> "The major oil reserves of the United States lie in some one billion, one hundred million (1,100,000,000) acres of lands underlain by sedimentary rocks, and not fully explored, in which geology indicates oil is possible. With extended search, new supplies will be found therein. There are approximately 827,000,000 acres where oil is not possible.
>
> "The Nation has an additional reserve in the vast deposits of oil shale, coal, and lignites, from all of which liquid fuel and lubricants may be extracted if and when the cost of recovery is justified by the price of these products. These products are so huge that they promise, under conservative estimates, an almost unlimited supply. There are about three hundred and ninety-four billion (394,000,000,000) short tons of oil shale, from which about one hundred and eight billion (108,000,000,000) barrels of crude shale oil can be recovered, yielding twenty-five billion (25,000,000,000) barrels of motor fuel.
>
> "A minimum estimate of five hundred and twenty-five billion (525,000,000,000) barrels of liquid products from the country deposits of coal, yielding an estimated ninety-two billion (92,000,000,000) barrels of motor fuel.
>
> "An estimated yield of seventy billion barrels of liquid products from the country's lignite deposits, twelve billion barrels of which could be used as motor fuel." (3)

1: Osborn,C. - Op.Cit. - p. 96
2: "American Petroleum - Supply and Demand" - p. 7
This book is a report to the American Petroleum Institute by the Committee of eleven.
3: "American Petroleum - Supply & Demand" - Op.Cit. - p. 7

The sub-committee (of the American Petroleum Institute) believes that the free petroleum reserve of the Nation includes: (1)

1: Oil to be recovered by present flowing and pumping methods from known producing and proved acreage.

2: Casing-head gasoline from known producing and proven acreage.

3: Oil remaining in the ground in known producing and proven fields after flowing and pumping cease.

4: Oil and casing-head gasoline to come from deeper oil bearing sands, not now producing, but known to be present beneath our present producing and proven areas.

5: Oil and casing-head gasoline to come from new fields and new producing districts, yet to be discovered in the large area in which new oil fields may logically be sought.

6: Oil which will remain in the ground under the fields yet to be discovered after flowing and pumping cease.

Control of Reserves

Ownership of the petroleum reserves is vested mainly in the hands of oil company lessees and corporate or private landowners or royalty holders. Ordinarily, when land is leased for oil production, the landowner or separate owner of the sub-surface mineral rights, as the case may be, retains a free one-eighth interest or royalty in the petroleum that may be produced. The lessee usually pays a cash price per acre, called a "bonus", and agrees to drill or pay an annual rental for the privilege of deferring developments. If the lease is not drilled or the rentals paid, the

1: "American Petroleum - Supply and Demand" - Op.Cit. - p.41

agreement is automatically canceled. (1)

Within the past few years some progress has been made in the co-operative pooling of oil-lease and royalty rights by landowners under centralized management whereby the income is divided either on the basis of headrights or the amount of acreage contributed. Much of this kind of pooling must be accomplished in advance of development. (2)

Americans own approximately 95 per cent of the production and most of the prospective oil land in the United States. About 5 per cent of the total production is controlled by foreign capital, mainly British-Dutch. (3)

Reserves in Foreign Countries

The underground reserves of most foreign countries are comparatively unknown. Practically no deep wells have been drilled for oil in many nations and the available geologic information is largely confined to seeps and outcrops. Of the important producing oil regions only the Tampico and Tuxpam areas of Mexico, the Maracaibo Basin of Venezuela, the Baku and Grozny districts of Russia, and certain areas of Roumania, Poland, and the Dutch East Indies are sufficiently developed to offer criteria comparable to those in United States for the estimation of their oil reserves. The best that can be offered is a scientific guess, based upon available data and subject to error.

The only scientific attempt that has been made to measure the reserves of foreign countries, in barrels, was

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1: Osborn,C. - Op.Cit. - p. 96
2: Ibid - p. 98
3: Ibid - p. 99
4: Ibid - p. 293

prepared by Eugene Stebinger of the United States Geological Survey and published in 1920 by David White, then chief geologist. The total figure was 36 billion barrels. White thought it was very conservative and that it could be brought up to 56 billion barrels since he thought there was probably 20 billion additional available barrels. (1)

Substitutes for Petroleum

There are no satisfactory substitutes for oils at competitive prices except as an illuminant, as a fuel under steam boilers, and for paving. In many places fuel oil displaces competitive coal under steam boilers. (2)

Lubricating oil is the most essential product of petroleum. For certain types of lubrication refined vegetable oils and possibly animal fats can be used, but for oiling high speed bearings and for all lubrication in the presence of the high temperature of internal-combustion motors there is no known commercial substitute for petroleum lubricants. Fuel oil is the raw material from which lubricants are made. (3)

Gasoline has no known satisfactory substitute as an internal combustion fuel for automotive purposes at competitive prices in this country. Benzol, obtained from coal, and alcohol, secured from vegetable material, have been used as substitutes, but they are not as satisfactory and cannot be produced in sufficient quantities as gasoline. Gasoline is a cheap, efficient and satisfactory motor fuel.(4)

1: Osborn,C. - Op.Cit. - p. 293
2: Ibid - p. 109
3: Ibid - p. 110
4: Ibid - p. 110

Kerosene is no longer useful as an illuminant except in rural districts. Coal, water, power, and oil are employed to generate electricity, which has supplanted kerosene.

For fast motorship purposes oil could not be displaced by competitive fuels at many times present prices, but with great reduction in efficiency these ships could be converted into coal burners. (1)

A: Coal

> Oils obtainable from certain types of coal are generally considered a most likely substitute for the high-grade petroleum products. Coal is available over widely distributed areas amd it has been shown that coal can be liquefied, and motor fuels, lubricants and other oils thus manufactured. (2)
>
> According to the Federal Conservation Board, the reserves of bituminous, sub-bituminous, and semi-bituminous coal within 3000 feet of the surface, together with lignite deposits, amount to about $3\frac{1}{2}$ trillion tons, and are capable of yielding over 100 billion barrels of motor fuel. Excluding the lignite, the estimated recoverable motor fuel is more than 300 times the actual output of gasoline from petroleum in this country in 1927. Much additional coal is available below 3000 feet and known deposits have scarcely been scratched. (3)
>
> Coal possesses some advantages over oil shales as a source of petroleum. Many of the deposits are located in areas of large gasoline consumption, whereas the largest of the oil-shale deposits are remote from the centres of population. The residue from coal is a valuable fuel. Spent shale is worthless and the expense of handling it high. The yield of oil would be

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1: Osborn, C. - Op.Cit. - p.110
2: Ibid - p. 111
3: Ibid - p. 111

> much higher than that obtainable from shale. (1)
>
> The output of benzol in a recent year amounted to about 90 million gallons, or less than one per cent of the gasoline yield in the same period. A considerable portion of the benzol output is blended with gasoline for motor fuel. Alone, benzol is not a satisfactory motor fuel. It is secured as a by-product in the distillation of coal at high temperatures for the production of coke and gas, but the yield amounts to only 3 or 4 gallons of light oil per ton. (2)

There are three methods for obtaining larger yields of products from coal similar to those made from petroleum.

1. Low temperature carbonization of coal.
2. Partial liquefaction at low temperatures by heating coal in an atmosphere of hydrogen.
3. Complete gasification of coal and the synthesis of liquid fuels. (3)

The first process is in commercial operation on a small scale in Germany and several units are operated intermittently in the United States, but the motor fuel is a by-product and the costs are high. Berguis has proposed a method whereby the second process can be accomplished experimentally and it is now being tried out on a commercial scale at Mannheim, Germany. The yield is about 100 gallons of liquid fuel per ton, from which 40 gallons of motor fuel is obtained. The costs are too high, and if oil prices should rise to high levels, some progress might be made with the methods. (4)

1: Osborn,C. - Op.Cit. - p. 112
2: Ibid - p. 112
3: Ibid - p.112
4: Ibid - p. 112-113

B: Oil Shale

According to the report of the American Petroleum Institute, the estimated amount of shale is 394 billion tons, from which 108 billion barrels of crude shale oil could be recovered. This is about ten times the cumulative quantity of petroleum produced in this country to date. The oil shale deposits are thicker than coal veins and the cost of mining should be less. (1)

Small quantities of shale oil have been reported in Scotland at times when oil prices were high, but it has not been shown that the methods are commercially suitable for American shales. (2)

For example, the oil-shale industry of the United States was inactive in 1931, as the low prices of crude and refined oils did not justify operation of the plants. The industry in foreign countries experienced a fairly satisfactory year in output, but profits were undoubtedly reduced by the world-wide slump in gasoline prices. The production of shale in the seven foreign countries reporting in 1931 was 2,394,925 metric tons. Of this amount, Scotland, the leading country, produced 1,760,557 metric tons; Estonia, 499,495 tons;France, 74,541 tons; and Spain, 55,611. (3)

Oil-shale operations, in order to be profitable, will have to be conducted on a very large scale, involving capital outlay of several millions of dollars for a single commercial plant. Unlike the oil industry, where a man with small capital, by making a strike, can often obtain a quick return of many times the capital invested, the oil-shale industry is likely to be a large-scale manufacturing industry with a small profit per ton of material treated. Although the industry, when once established, will doubtless pay a fair return on the capital invested, it may be difficult to finance operations until the supply of crude oil

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1: Osborn,C. - Op.Cit. - p. 113
2: Ibid - p. 113
3: U.S.Department of Commerce, Bureau of Mines, "Crude Petroleum and Petroleum Products in 1931", II:29, - p. 669

is definitely on the decline or until the demand exceeds the supply over a period of years. (1)

C: Alcohol

After some mechanical adjustments have been made in automobile engines, this product has been used to a small extent where prices are high. Since alcohol is derived mainly from plants, it presents many interesting aspects as a possible motor fuel. (2)

Corn and molasses are the only vegetable products that approach commercial possibilities at this time. The World's supply of cane sugar, however, would furnish only enough by-product molasses to yield the equivalent of about 2 per cent of one year's consumption of gasoline in the United States. If the entire corn crop of this country were converted into alcohol, it would yield a little less than one-half of the annual consumption of motor fuel. It is estimated that about 10 acres of corn or 46 acres of sugar cane would be necessary to supply motor fuel to the average car. (3)

Potatoes and sugar beets offer possibilities, but at present the acreage devoted to the cultivation of these crops is too small to be considered. Thus, large increases in tilled land and farm labor would be involved in substitution of alcohol for gasoline. Cost is also an important factor to be considered. (4)

1: Federal Oil Conservation Commission, Second Report to the President of the United States.
2: Osborn, C. - Op.Cit. - P. 115
3: Ibid - p. 115
4: Ibid - p. 115

C H A P T E R V

PRODUCTION AND REFINING IN FOREIGN COUNTRIES

Production

Petroleum is produced on a commercial scale in some twenty-six countries, with the United States by far the most important. Since the recording of production was begun in 1857, the world has yielded 18,638,505,000 barrels, of which 12,249,149,000 barrels have been produced in this country. More than 1,500,000,000 barrels are produced annually and United States supplies the billion. (1)

Of the countries producing petroleum on a commercial scale, eight contribute 96 per cent. These are: the United States, Venezuela, Russia (including the Island of Sakhalin), Mexico, Persia, Netherlands, East Indies, Roumania, and Colombia. (2)

Up to the present time, this country has produced two-thirds of the world's total output of petroleum. Russia is next in importance, with less than one-seventh. Mexico has contributed about five percent. The remaining fifteen per cent is scattered over many minor fields. At the turn of the century, Russia was the leading producer with United States second. Owing to the greater ease with which petroleum could be produced in this country, the greater accessibility of American supplies, and the better organization of the American refining industry, the United States rapidly expanded its production from less than 70 million barrels in 1901 to more than 1 billion barrels in 1929,

1: "Petroleum Facts and Figures", Division of Public Relations, American Petroleum Institute, 3rd edition, p. 5
2: Ibid - Loc.Cit.

[illegible]

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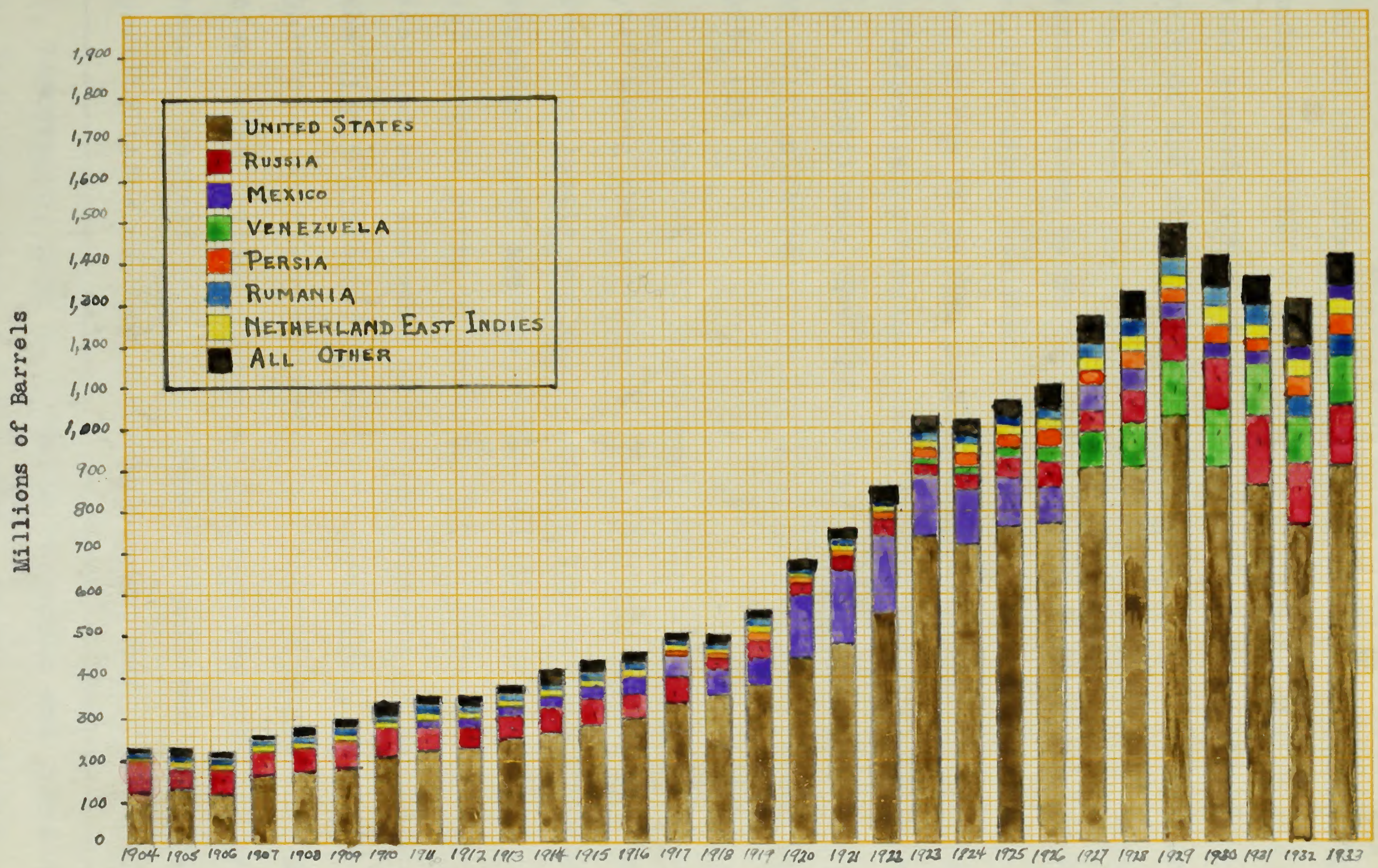
1: "Petroleum Facts and Figures", Division of Public Relations, American Petroleum Institute, 3rd edition, p. 6

2: Ibid., loc.cit.



World Production of Crude Petroleum, by countries, 1904-33

Note: This chart shows the output of the leading crude oil producing countries as reported officially to the U.S. Bureau of Mines from 1904 to 1931, and for United States for 1932 and 1933. The output of the foreign countries for 1932 and 1933 is based upon figures obtained from the Oil and Gas Journal

while Russian production stagnated before the War at around 65 million barrels and declined sharply during the War. Today Russia, with an output of probably not much less than 200 million barrels, is second and is rapidly forging ahead under the stimulus of a planned economy. Venezuela, which held second rank in 1930, is dropping back, largely as a result of the stabilization efforts of the large international oil companies which dominate the oil industry of that country. Mexico, whose output in 1921 closely approached the 200 million line, has been dropping back steadily during the last ten or twelve years, partly because of legislative reforms unfavorable to foreign investors and partly because of physical conditions. The Mexican output in 1931 amounted to only 33 million barrels, or 2.4 per cent of the world's total output. (1)

Actual oil production is quite inequitably distributed among the continents, but the petroleum resources of some continents are still largely undeveloped. Geologists consider North America by far the richest section in oil. But certain parts of North America, Central America, the West Indies, and most of Mexico, consist of mountain ranges too highly disturbed to be highly prolific, although the Gulf Coastal Plain of Mexico has been astonishingly productive. The British Colony of Trinidad has some oil and large natural asphalt deposits. Canada and Alaska have oil possibilities not yet fully developed. (2)

1: Zimmermann, Eric W. - "World Resources and Industries" - p. 481-482
2: "Petroleum Facts and Figures" - Op.Cit. - p. 5-6

Great possibilities for oil are believed to exist in the little explored and undeveloped South American Continent, since Venezuela, Colombia, Peru, and Ecuador already have yielded a rich production. (1)

The rocks of Central and Western Europe, geologists say, are too broken and disturbed to permit accumulation of oil in large quantities, but many small fields have been,and probably will be developed, particularly in Roumania,Galicia, Languedoc, Hanover, and northern Italy. In eastern Europe, however, beneath the great plains of Russia and the Baltic countries, are broadly-folded geologic beds not unlike those of the Mid-Continent oil fields of the United States. Russia particularly is believed to possess a wealth of undeveloped oil territory. Formations on the flanks of the Caucasus already have yielded quantities of oil, with most of the production taken from the Baku region. Northern Europe alone shows little indication of commercial accumulations. A sizable old shale industry has been developed in Scotland, but attempts to find oil in commercial quantities generally throughout the British Isles have met with little success.(2)

The drill, final authority for the presence of oil, has established the productive possibilities of Asia, especially in Iraq (Mesopotamia), southwestern Persia, the Punjab, Burma, Szechwan and Shensi provinces of China, in Siberia, and in Netherland East Indies. Some possibilities are seen in the southwestern plateaus of Arabia, Syria and

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1: "Petroleum Facts and Figures" -Loc.Cit. -
2: Ibid - Loc.Cit.

Palestine. Production is under way in Borneo, Java, Sumatra, and Sarawak. Production only on a small scale has been developed in Africa, and that chiefly in Egypt. Australia, New Zealand, and other island countries of the Pacific Ocean show little, if any, promise. (1)

The gain in demand during the past 20 years has been met in large part by an annual average increase of about 10 per cent in the foreign production. The rate of growth was retarded during the World War, but since 1923 the rate of increase has been steadily growing. (2)

Venezuela, one of the newest producing nations, has become a leader. Seven years ago the output of this country was small, but owing to her prolific reserves, the aggressiveness of the producers, favorable laws and national policies, and a ready market of oil, it is probable that she will continue to forge ahead. Though the mineral rights are vested in the Government, concessions are granted to foreigners. The royalties range from 7½ to 11¼ per cent. American and British-Dutch companies produce the greater part of the oil. The cost of production is about 56 cents per barrel. (3)

Mexico, up to 1922, was long the principal foreign producing company. But in this year and succeeding ones underground water encroached upon her bonanza pools in the Tuxpam area and she has been steadily declining until she now occupies seventh place. The low cost of production and profuse output of Mexico was a feature in her prime although

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1: "Petroleum Facts and Figures" - Op.Cit. - p. 6
2: Osborn, C. - Op.Cit. - p. 290
3: Ibid - p. 290-291

she produced oil of a low grade. Leases were readily secured by foreign companies - namely, American and British-Dutch, during the Diaz regime. (1)

In 1911, after the assassination of Diaz, succeeding revolutions broke forth with the result that a Constitution was finally set up in 1917 which attempted to nullify these titles and reinvest the oil lands of Mexico. After much agitation between Mexico and foreign countries, compromises were made and the dispute concerning vested rights temporarily settled in a satisfactory manner. Nevertheless, production continues to decline in this country. (2)

Russia ranks second among the foreign oil-producing countries. At the close of the nineteenth century the output of this nation exceeded that of the United States for a short time. During the World War and until 1920 it dropped rapidly to yield only about one-third of its original production. When the Soviet Government came into power, the national oil resources and the industry were converted into a governmental monopoly. From thenceforth, up-to-date equipment was imported and installed, technical oil men from other nations were employed and development pushed forward. Thus Russia, rich in petroleum resources, has materially increased her yield in excess of pre-war production. (3)

Persia, fourth among foreign oil-producing countries, has yielded over 100,000 barrels per day. The oil is produced by the Anglo-Persian Company from a portion of the D'Arcy concession covering five-sixths of Persia. The fields are well served with pipelines, the oil is of good quality, the wells prolific, the reserve large and this Company is

1: Osborn,C. - Op.Cit. - p. 291
2: Ibid - p. 291
3: Ibid - p. 292

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1: Osborn, - op. cit. - p. 201
2: Ibid - p. 201
3: Ibid - p. 202

backed by the British Government. The outlook for future production is very good. (1)

The Dutch East Indies, Roumania, Colombia, Peru, and Poland, are also fair producing countries. The output of the Roumanian pools was practically wiped out during the World War, but it has now grown to 200 per cent over pre-war production. Colombia has grown only during the past seven years and Peru has yielded oil for a long time with ever-increasing output. (2)

Refining

Large refineries have been built on the islands of Curacao, Trinidad, and Aruba, which lie along the northern shore of Venezuela. The Royal-Dutch-Shell refinery on Curacao is one of the largest in the world. These plants refine South American, especially Venezuelan, crudes.Russia is building large refineries to add to her present capacity, her refineries in 1930 having worked up over 16 million tons of crude oil. Roumanian refineries, during the same year, treated close to six million tons. Great Britain, the second largest consumer of petroleum products in the world, has built up a large refining industry since the War which, at present, treats principally Persian crudes. France is laying plans to work up Mosul oil, which the pipeline to Tripoli will make available to that country. Several other European nations, even those that do not produce any crude oil, have established refineries, in several cases under

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1: Osborn,C. - Op.Cit. - p. 292-293
2: Ibid - p. 293

direct Government influence. In Asia the three most important oil producing countries - Persia, the Dutch East Indies, and Burma - possess well-equipped refining industries; and in Egypt also a modern refinery has been erected. (1)

World Production During 1932

The world production of crude petroleum during 1932 totaled 1,305,937,000 barrels, a decrease of nearly 67,000,000 barrels, or 5 per cent from 1931. In 1932, as in 1931, production outside the United States increased; consequently, the ratio of production in the United States to the world total declined from 62 per cent in 1931 to 60.1 per cent in 1932. Production in 1932 was divided according to continents as follows: North America, 62.5 per cent; South America, including Trinidad, 12.8 per cent; Europe, 16.6 per cent; Asia, including Japan, East Indies, and Sakhalin, 8 per cent; and Africa 0.1 per cent. These data indicate chiefly a gain in the relative proportion produced in the Eastern Hemisphere. (2)

Production in Russia showed a small decline in 1932, although it was the last year of the 5-year plan. However, that country continued to rank second to the United States in production, with plans to triple the output under a new 5-year plan.(3)

The production of Venezuela, the third-ranking nation, totaled 116,300,000 barrels in 1932, virtually the same as in 1931. Drilling declined materially in Venezuela in 1932.(4)

1: "World Resources and Industries", by Eric W. Zimmermann - p. 516-517
2: "Minerals Yearbook 1932-1933", U.S.Bureau of Mines - p.482-483 (819 pages)
3: Ibid - Loc.Cit.
4: Ibid - Loc.Cit.

Production in Rumania rose to a new high level in 1932, due to competitive drilling in certain prolific fields. Production in Persia also reached a new high level in 1932, although the gain was due to increased demand. Production in Mexico continued to decline, although the drop in 1932 was relatively small. (1)

1: "Minerals Yearbook 1932-1933", United States Bureau of Mines - p. 482-483 (819 pages)

TABLE 3

World Production of Crude Petroleum, 1932,1933
and Total 1857-1933 - by Countries

Country	1932 # Thousands of Barrels of 42 U.S.Gallons	1932 # Percentage of Total by Volume	1933 * Thousands of Barrels of 42 U.S.Gallons	1933 * Percentage of Total by Volume	1857-1933 ** Thousands of Barrels of 42 U. S. Gallons	1857-1933 ** Percentage of Total by Volume
United States	785,159	60.12	898,874	63.48	15,683,597	64,97
Russia(U.S.S.R.)	155,250	11.88	150,000	10.59	3,024,859	12.53
Venezuela	116,300	8.9	118,000	8.33	867,747	3.59
Rumania	54,160	4.14	51,000	3.6	536,817	2.22
Persia	49,470	3.78	48.000	3.39	531,375	2.20
Netherland E.I.	39,000	2.98	38,000	2.68	589,819	2.44
Mexico	32,805	2.51	33,000	2.33	1,698,261	7.03
Colombia	16,417	1.25	13,500	.95	132,507	.54
Argentina	13,000	.99	14,000	.98	109,380	.45
Peru	9,900	.75	14,000	.98	154,875	.64
Trinidad	10,100	.77	9,500	.67	93,165	.38
India,British	8,430	.64	8,500	.60	233,368	.96
Poland	4,115	.31	3,800	.26	235,740	.99
Sarawak(Brit.Borneo)	2,400	.18	2,300	.16	54,621)	
Sakhalin Island	2,800	.21	2,900	.20	12,856)	
Japan	1,630	.12	2,300	.16	66,977)	
Egypt	1,790	.13	1,600	.11	26,573)	
Ecuador	1,595	.12	1,600	.11	10,430)	
Germany	1,617	.12	1,600	.11	25,975)	1.00
Canada	1,057	.08	1,100	.07	33,697)	
Iraq	910	.06	1,100	.07	5,598)	
France	528	.04	-----		6,988)x	
Czechoslovakia	190	.01	-----		1,569)x	
Italy	210	.01	-----		1,793)x	
Bolivia	44	---	-----		125)x	
Other Countries	60	---	-----		1,004)x	
	1,308,937	100.0	1,414,774	100.0	24,139,716	100.0

#: Figures for production of foreign countries for 1932 taken from Oil and Gas Journal, December 28, 1933.

*: Figures for 1933 from Oil and Gas Journal January 25, 1934, and are estimate of V.R.Garfias (Foreign Oil Dept.,Henry L.Doherty Co.N.Y.)

**: Totals for 1857-1931 obtained from table on p. 593 "Crude Petroleum and Petroleum Products in 1931", U.S.Dept. of Commerce, Bureau of Mines.

x: Figures are total of 1857-1932 only. Figures for 1933 are not available for these countries.

World's Activities in Crude Oil During 1932

The world's production of crude petroleum in 1932 totaled close to 1,309,000,000 barrels, and it is estimated that the same volume was run through refineries. Imports aggregated about 203 million barrels and exports 210 million barrels, the 4 million odd barrels necessary to balance these figures representing oil taken out of storage. (1)

The United States imported more crude than it exported and refined more than it produced, the deficiency being made up by a reduction of stocks of close to 20 million barrels. (2)

Russia put into storage during the year about 10 million and exported close to 4 million barrels of crude petroleum out of a production of 155 million barrels. The storing and exporting was mostly due to a lack of adequate refining facilities. (3)

Practically the entire production of Venezuela was exported as crude to the Dutch West Indies, i.e., 113 million out of 116 million barrels, and of this, less than nine per cent was re-exported as crude, the balance being run through the refineries at Aruba and Curacao. (4)

The bulk of the Roumanian production was refined within Roumania and only about two per cent was exported. About 25 per cent of the entire Persian production was exported as crude and the balance, or 75 per cent, refined at Abadam at the head of the Persian Gulf. (5)

1: V.R.Garfias & R.V.Whetsel: "World's Crude Oil Balance Sheet for Year 1932" - Oil and Gas Journal, May 18,1933, p.15.
2: Ibid - Loc. Cit.
3: Ibid - Loc. Cit.
4: Ibid - Loc. Cit.

The production of the fields of Dutch East Indies and Sarawak was mostly refined locally and only about 20 per cent was exported. (1)

Twenty-eight per cent of the oil produced in Mexico, mostly heavy asphaltic grade, was exported, United States receiving much of it. Practically the entire output of the Colombian fields was exported as crude, mostly to the United States, while the oil produced in Argentina, British India, Poland, Egypt, Japan and Germany was all refined and consumed locally. (2)

Important refining activities are being conducted in countries that have little or no crude production of their own. This applies to the United Kingdom, Canada, France, Japan, Australia, and Germany in line with the policy of diverting to the consuming country whatever profit or advantage there may be in carrying operations at home. Outstanding examples of this policy is shown by Canada, producing only one million barrels and yet importing 28 million; France, producing half a million barrels and importing 7 million; Dutch West Indies, producing not a barrel and importing over 94 million barrels; and the United Kingdom producing nothing and importing over 10 million barrels. (3)

Table #4 summarizes the crude oil movements during 1932. The figures (in thousands of barrels of 42 U.S. barrels) are believed to give a true picture, although they are subject to revision.

1: Garfias,V.R., and Whetsel, R.V. - Op.Cit.
2: Ibid - Op.Cit.

3: V.R.Garfias,and R.V.Whetsel - Op. Cit.

TABLE 4

World's Crude Oil Balance Sheet for 1932

(In Thousands 42 U.S.Gallons)

	Production	Imports	Exports	To Local Refineries	To Local Consumption and Storage
United States	781.845	44,688	27,393	819,997	* 20,857
Russia	155,250	------	3,850	141,400	10,000
Venezuela	116,300	------	113,489	2,811	------
Rumania	54,160	------	1,029	51,070	2,061
Persia	49,470	------	12,335	37,135	------
Dutch East Indies	39,000	------	7,250	31,750	------
Mexico	32,805	164	9,198	20,068	3,703
Colombia	16,417	------	15,142	968	307
Argentina	13,000	1,860	------	14,860	------
Trinidad	10,100	------	2,522	7,578	------
Peru	9,900	------	5,208	4,692	------
British India	8,430	------	-----	8,430	------
Poland	4,115	------	-----	4,115	------
Sakhalin Island	2,800	------	2,390	-----	410
Sarawak	2,400	------	762	1,638	------
Egypt	1,790	701	-----	2,491	------
Japan	1,630	5,122	-----	6,752	------
Germany	1,617	2,048	-----	3,665	------
Ecuador	1,595	-----	1,348	155	92
Canada	1,057	28,080	165	28,972	------
Iraq	910	------	-----	910	------
France	528	7,245	-----	7,773	------
Italy	210	630	-----	840	------
Czechoslovakia	190	860	-----	1,050	------
Bolivia	44	------	------	44	------
Cuba	12	650	------	662	------
Dutch West Indies	------	94,561	8,250	86,311	------
United Kingdom	-------	10,526	-----	10,526	------
Australia	------	2,537	-----	2,537	------
Austria	-------	900	-----	900	------
Holland	------	679	-----	679	
Yugoslavia	------	410	-----	410	------
Norway	------	216	-----	216	------
Sweden	------	197	-----	197	------
Hungary	------	103	-----	103	------
Belgium	------	60	-----	60	------
Latvia	------	44	-----	44	------
Others	48	-----	48	-----	------
Total	1,305,623	202,281	210,379	1,301,809	4,284

* Decrease

Now, that the status of foreign countries carrying on the production of petroleum has been treated in general, the following data will treat more specifically with each country in the field of producing and refining. First of all, the biggest producing countries of the Eastern Hemisphere will be considered according to their importance; then the countries of the Western Hemisphere will be treated likewise with the exception of the United States, which has already been dealt with in the preceding pages.

RUSSIA

The petroleum industry in Russia is organized as a Government monopoly, the control of the industry being vested in a number of trusts charged with the conduct of the different phases. Unit control is possible on account of Government ownership and operation of all the oil fields. Absence of property lines and lease obligations permits the development of each structure in accordance with the best judgment of the technologists in charge. (1)

Intensive exploitation of the older producing areas, together with a hasty development of recently discovered fields, gives promise of a large increase in Russia's rate of crude production in the near future. (2)

Practically all Russian petroleum comes from fields which were under exploitation when the Soviet Government confiscated them. Azneft, the biggest division of the oil

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1: Institution of Petroleum Technologists Journal, March, 1934 - p. 126-A
2: Ibid - Loc.Cit.

trust, comprises the territory around Baku; Grozneft, that territory around Grozny; and Maineft is that region around Maikop, at the eastern end of the Caucasian Mountains. Thus, virtually all the oil comes from the Caucasian region between the Caspian and the Black Seas. (1)

The most important producing districts are those of Baku, Grozny and Maikop, and reference is made to the #45 well, the Lok Batan, which produced such enormous quantities of oil in the year 1933. Another important new district in the Azneft territory has been discovered near Kala. Two wells on this site are producing about 3000 (21,000 barrels) tons per day each, and it appears that Lok Batan and Kala alone will produce between 20 and 40 per cent of the production scheduled for Azneft for 1934 (20 million tons) under the Five Year Plan. (2)

The two principal sources of consumption in Russia are tractors and automobiles, of which the production has been steadily increased. Moreover, the home consumption of grades of spirit and light oils are increasing. (3)

At the start of the year each operating trust under the U.S.S.R. is given a certain quota which it is expected to fulfill before the end of the year. Also, a definite program is drawn up by the U.S.S.R. which calls for the drilling of more wells in the proven and semi-proven areas with a number of wildcat tests in sections where promising geophysical data have been obtained. (4)

1: "Petroleum in U.S.S.R.", - p. 439 - Institute of Petroleum Technologists Journal, May 1932.
2: Institution of Petroleum Technologists, January 1934 - 100 pages - p. 4-A
3: Ibid
4: "News from Foreign Lands", Oil and Gas Journal - p. 18 - February 15, 1934

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1; "Petroleum in U.S.S.R.", - p. 438 - Institute of Petroleum Technologists Journal, May 1932.
2; Institution of Petroleum Technologists, January 1934 - 101 pages - p. 2-A
3; Ibid
4; "News from Foreign Lands". Oil and Gas Journal - p. 15 - February 15, 1934

The peak in Russian crude oil production was in 1931 when it totaled 162,842,000 barrels. Field activity increased the latter part of 1933 and this was reflected in greater output. The production was aided by the drilling of several wells of the gusher type in the Lok-Batan district of Baku. (1)

Russia, up to January 1, 1934, has produced about 12.5 per cent of the world's total petroleum production. In the year 1932 she produced about 12 per cent of the world's petroleum production and in 1933 this percentage was about 10.5.

Trusts	Crude Oil Production 1932 & 1933	
	1933	1932
Azneft	15,526,600	12,181,300
Grozneft	4,866,700	7,709,700
Maineft	606,100	925,100
Embaneft	194,400	247,000
Other Trusts	246,200	312,100
	21,440,000	21,375,200

(Data in Metric Tons ----- 1 ton equals 7 barrels)

The Russian production of refined kerosene increased in 1933 over 1932. Russian production of kerosene exceeded the gasoline production in these two years. It is an important factor in its export markets. (2)

The U.S.S.R. increased its production of lubricating oils in 1933, according to available information. More

1: "News from Foreign Lands", Oil and Gas Journal - p. 18 - February 15, 1934.
2: Ibid - p. 18

of its lubricating oils were offered in European markets during 1933. The country has a large productions of crudes suitable for the manufacture of steam refined stocks and bright stocks and also overhead oils. (1)

A new pipe line connecting the oil area in the Grozny district - Malgobek, with the town Mozdok, where the new pipe line is connected with the pipeline Grozny-Touapse, the oil export port - was completed recently. The crude from Malgobek is to be refined at Touapse, and the oil products from Malgobek crude will be exported. (2)

The refineries in operation September 1931 are listed below: (3)

Trust	Location	Refineries	Daily Capacity Barrels
Azneft	(Baku	21 *	208,000
	(Batum	2 #	6,000
Grozneft	(Grozni	9 #	119,000
	(Touapse	1	6,500
	(Leningrad	1	300
	(Krasnodar	1	3,000
Neftisavodi	(Konstantinovska	1	5,500
(Home Office	(Varinsk	1	3,000
Guryev).....	(Uzbez Republic	1	400
		38	351,700

* Eight complete with cracking units; # Two complete with cracking units.

Russian refineries have additional refining capacity under construction and probably completed at this date.

1: Oil and Gas Journal - p. 18 - February 15, 1934 - "News from Foreign Lands".
2: Ibid - p. 18
3: U.S.Dept. of Commerce, Bureau of Foreign and Domestic Commerce; Trade Information Bulletin No.784 - 44 pages - 1932 - p. 36

They are: Azneft at Baku, 2 pipe stills, 1 shell still battery, 1 paraffin and de-waxing plant, 4 cracking units, 1 high-vacuum still, and 4 cracking units and i pipe still; Neftizarodi at Konstantinovska, 1 cracking unit; Middle Asianeft at Kokand, 1 cracking unit; and Sakhalinneft at Chabarovsk, 1 cracking unit. (1)

ROUMANIA

Roumania, Poland and Soviet Russia are the only European countries able to supply the necessary quantity for their needs and to have a margin for export, the commercialization of Roumanian petroleum products being divided in the proportion of 80 per cent for export and 20 per cent for internal consumption. In spite of the fact that the quantities exported, especially from Roumania, are fairly important, the total supply of these three countries is insufficient to meet the needs of the European and African countries. (2)

During the post-war period, the Roumanian oil industry made big strides, its production growing at a considerable rate. Its rate also grew in proportion as the entire surplus production was taken over by the consuming countries, whereas the home consumption has remained about stationary for a long period, principally owing to the fact that Roumania owns other power generating elements besides oil. (3)

The increase of the crude oil production and

1: U.S.Department of Commerce, Trade Information Bulletin No. 784 - p. 36

2: "Petroleum in Roumania" by Mihail Pizanty, printed by Atelierele Grafice Coltora Nationala, Bucharest, 1930 - 100 pages - p. 5

3: Ibid - Loc.Cit.

especially of the exportable quantity could not have been achieved without the large co-operation of foreign capital. This capital was invested in exploitations, refineries,means of transport and sale, leading this industry into a prosperous channel. (1)

Concessions are granted to private companies by auction on a royalty basis and by payment to the State of an amount in cash, or under the shape of a co-association between the lessee and the State, in accordance with the Law for the organization and administration on a commercial basis of public property and undertakings. (2)

All Roumanian oil production is obtained from salt domes, some buried, others at the surface. The oil-bearing region extends throughout the southeastern side of the Carpathians, including especially the districts of Danibovita, Prahova, Buzan, and Bacau. Oil occurs also in the Putna district, where we find some old workings. Traces of oil occur also in the districts of Goof, Neamt, and Vipieta. A small oil basin occurs also at Sacel in the Maramuresh district. (3)

The area of the oil-bearing regions amounts to 120,000 hectares, more than 46,000 hectares of which are leased to various firms and only about 4,000 hectares are actually under exploitation; the latter figure includes also the recent area leased by the State. (4)

In the pre-war period, the oil industry has recorded a maximum production in 1913 yielding 1,885,619 tons.

1: "Petroleum in Roumania" by Mihail Pizanty; printed by Atelierele Grafice Coltora Nationala, Bucharest,1930 - 100 pages - p. 5
2: Ibid - p. 9
3: Ibid - p. 14
4: Ibid - p. 14

During the war, at the retreat of the Roumanian Army, the wells were closed and the storage tanks destroyed to avoid their utilization by the enemy. In spite of this, however, during the occupation a certain number of wells were repaired and a small production obtained. (1)

Beginning with 1920, Roumania's output has shown a steady increase, the production for 1933 being 10.4 per cent better than that of 1931, and the latter one exceeding by 15.4 per cent the figure for 1930. (2)

The commercialization of the petroleum products is divided in the proportion of 80 per cent for export and 20 per cent for internal consumption. (3)

During the past five years Roumania's crude oil production has increased by 72 per cent, exports by 170 per cent, while internal consumption remained on the same level with the exception of 1933, which showed an increase of 14.5 per cent as compared with the previous year. (4)

PRODUCTION AND EXPORT OF PETROLEUM AND PETROLEUM PRODUCTS
in 1000 tons (1 ton equals 7 barrels)

Year	Total Output	Exports
1928	4,282	2,344
1929	4,837	2,823
1930	5,792	3,856
1931	6,756	4,647
1932	7,350	5,166

Due to the fact that Roumania exports 80 per cent of its annual production, the influence of Roumanian production in the European market and in the international

1: "Petroleum in Roumania", by Mihail Pizanty; printed by Atelierele Grafice Coltora Nationala, Bucharest, 1930, p. 14
2: Oil and Gas Journal - p. 10 - March 29, 1934.
3: Ibid - p. 10
4: Ibid - p. 10

petroleum industry is more important than its ranking position as the fourth oil producing country of the world would indicate and the facts stated above will bear this out.(1)

PRODUCTION OF THE VARIOUS DISTRICTS DURING 1928 and 1929

District	1929	Per Cent	1928	Per Cent
Prahova	3,371,636	69.88	3,011,116	70.54
Dambovitza	1,290,641	26.72	1,074,397	25.17
Bacau	86,405	1,78	112,512	2.63
Buzau	78,596	1.62	70,516	1.66
	4,827,278	100.00	4,268,541	100.00

The participation of various capitals in the country's production is as follows:

British Capital	owns	20.0%	of production
Anglo-Dutch "	"	20.2%	" "
Franco-Belgian Capital	"	23.0%	" "
Roumanian "	"	20.0%	" "
Idem participating with foreign companies	"	7.7%	" "
American Capital	"	6.6%	" "
Italian "	"	1.7%	" "
Other "	"	0.8%	" "
Total		100.0%	

At the beginning of 1930 there were over 100 companies constituted under the form of Roumanian corporations for the exploitation, treatment and marketing of oil.

Roumania is the fourth largest producer of petroleum at the present time and refines by far the largest part

1: Oil Weekly - May 14, 1934 - p. 9

of its crude production in the 55 refineries now operating within its boundaries. (1)

It has been estimated that these refineries with a total capacity of approximately 58,000,000 barrels of crude annually or 158,900 daily, represent a combined capital of about $60,000,000. (2)

The use of cracking installations is not large; only four of the larger refineries, the Steana-Po-Mana refinery at Campina, the Astra-Romana refinery at Ploesti, the Romano-Americana refinery at Teleapen, and the "Xenia" refinery of the Romano-Africana Co. at Ploesti, now having cracking equipment. The annual capacities of these cracking plants are reported to be 1,680,000 barrels, 2,555,000 barrels, 700,000 barrels, and 420,000 barrels, respectively. The average percentage of gasoline now obtained by the Roumanian refineries is about 20.(3)

At present natural-gasoline plants are reported to be in operation at six refineries: Astra-Romana at Ploesti, Steana-Romana at Campina, Univea and Orion at Ploesti, Romano-Americana at Teleagen, Anrova refinery at Baicoi, and the Teleagd refinery at Teleagd. The existing or projected plants at present provide a production capacity of about 2,661 barrels of gasoline daily. The utilized production is reported to be about 1,951 barrels daily. (4)

Roumania is also a gas producing country, the gas containing 98% methane.

1: "Petroleum Refineries in Foreign Countries" - Trade Information Bulletin No.784 - U.S.Department of Commerce - p. 34
2: Ibid - p. 34
3: Ibid
4: Ibid

PERSIA

Persia is fifth ranking oil producing country in the world. In 1932 she produced about 3.8 per cent of the world's production and in 1933 she produced about 3.4 per cent.

The Anglo-Persian Oil Company operates wells at Masjid-i-Sulaiman and Haft-Kel, the other two areas together extending over 90 square miles and producing 7 million tons of high grade crude oil in 1933. Pipe lines 145 miles long connect the fields with the refinery four square miles in area at Abadam. A subsidiary company recently formed, the "Kermanshah Petroleum Company", has a field at Naft-Kanah on the Iraq frontier, whence it will transport its crude oil by pipe line to a refinery in course of construction at Kermanshah. (1)

The Anglo-Persian Oil Company (Ltd.) is the only company operating a refinery in Persia, and that is the one at Abadam, close to the Persian Gulf. The plant equipment is modern, and the crude comes from the district around Masjid-i-Sulaiman, and Haft-Kel in southwest Persia. The products are kerosene, benzene, and fuel oils; the total output of refined products and residuals in 1930 being 34,500,000 barrels. (2)

DUTCH EAST INDIES

There are 10 refineries in the Netherland East Indies which are distributed as follows: 4 in Sumatra, 4 in Sumatra, 4 in Java, 1 in Borneo, and one on the Island of

1: "Petroleum in Persia", Mon. Petroleum Roumain, 1934, 35, 845-847

2: U.S.Department of Commerce, Trade Information Bulletin #784 - "Petroleum Refineries in Foreign Countries" - p. 31

Ceram. (1)

The Bataafsche Petroleum Maatschappij (hereafter referred to as the B.P.M.), a subsidiary of the Royal-Dutch-Shell group, has seven working refineries. The largest refinery in the islands is that of the B.P.M. at Balik Paparon the island of Borneo. (2)

Two of the other three refineries, one at Soengei-Gerong, near Palembang in South Sumatra, and a small refinery at Kapoean, in east-central Java, are owned by the Nederlandsche Koloniale Petroleum Maatschappij (hereafter referred to as the Koloniale), a subsidiary of an American company. The other refinery, located at Klantoeng in central Java, west of Samorang, is owned by the Algemeene Petroleum Company. (3)

In each case the crude petroleum is obtained from concessions located in the general vicinity of the refinery, the producing wells and refinery being operated by the same controlling interests. Gasoline, kerosene, turpentine substitute, solar oil, fuel oil, Diesel oil, asphalt, lubricating oils and greases, and paraffin are obtained from the various refineries. (4)

There is, however, considerable variation in the quality of the crude oil produced on the different islands. Nearly all of the North Sumatra crude oils are especially rich in light products and contain little or no paraffin. South Sumatra crude, on the other hand, yields considerable

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1: "Petroleum Refineries in Foreign Countries",1931" - Department of Commerce - p. 26 - Trade Information Bulletin No. 784.
2: Ibid - Loc.Cit.
3: Ibid - Loc.Cit.
4: Ibid - Loc.Cit.

paraffin. The Borneo crude oils vary considerably in composition, even in the same field. The Torakan oils yield, as a rule, little gasoline. Some of them contain no kerosene.(1)

The refineries in Java and Borneo put out a large quantity of paraffin wax. A large part of the wax is used for candles, which, on account of the high melting point of Borneo paraffin, are particularly suitable for use in the tropics. (2)

The capacity of all Dutch East Indies refineries is indicated by the following statement of production in 1930:

	Barrels
Java and Madeira	4,600,000
Sumatra	17,875,000
Borneo	18,600,000
Ceram	325,000
Total	41,400,000
Exports, 1930	6,005,021
Total for Refinery	35,400,000

Borneo - at Balikpapan, on the east coast of Dutch East Indies, is located by far the largest refinery in the Dutch East Indies. It is owned by the B.P.M. Its daily capacity is estimated at 35,000 barrels. Crude oil is received through pipe lines at the refinery from the oil fields. At this refinery practically all petroleum products, from light distillates to asphalt, are produced.

On Torakan Island, on the northeast coast of Borneo, is a plant at which the crude oil from the Torakan fields on

1: "Petroleum Refineries in Foreign Countries 1931" - Op. Cit. - p. 26-27
2: Ibid - p. 27
3: Ibid - p. 27

the mainland is prepared as fuel oil. There is no refinery at this point, the crude oil being of such quality that by a very simple process the water and sand can be removed, rendering the oil immediately suitable for bunkering without further treatment. Ample storage facilities exist for both crude oil and the prepared fuel oil. Besides distribution through a fueling station on Torakan Island, considerable quantities of both crude oil and prepared fuel oil are exported, much going to Japan. (1)

Ceram:- There is a small topping plant at Boela Bay, on the northeastern coast of Ceram, owned by the Dordtische Petroleum Co. (a subsidiary of the B.P.M.) The crude oil from the fields in Ceram are topped for the lighter products at Boela Bay, the topped crude being shipped to the Company's refinery at Balik Papan for the final refining processes. The residue is sold in Ceram at a small fueling station near the topping plant.

Java:- Of the four refineries on the Island of Java, two are controlled by the B.P.M., one by the Koloniale, and the fourth and last by the Algemeene Petroleum Co. (2)

The refinery at Wonokromo, near Surabaya,controlled by the B.P.M., has an approximate capacity of 2,000 barrels. The crude oil supplies arrive in tank cars from various concessions in the vicinity. The main product of the refinery is kerosene, most of which is marketed locally. A small amount of gasoline is produced. Lubricating oils are made

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1: "Petroleum Refineries in Foreign Countries 1931", Op.Cit. - p. 27
2: Ibid - p. 27-28

and sold to the sugar and rice mills of Java, as well as to the automotive trade. (1)

The refinery at Tjepoe, also owned by the B.P.M., is a complete plant and has a capacity of 6,000 barrels a day. Its average production daily is about 9,500 barrels. Much of the crude oil handled at this refinery carries paraffin especially suitable for the manufacture of candles. A candle factory is operated by the Company in conjunction with the refinery. Gasoline and kerosene are the principal producta produced at Tjepoe. (2)

Koloniale operates a small refinery at Kapolan. It produces about 5,000 barrels daily on crude obtained from wells drilled on territory granted by the Netherland East Indies Government in July 1928.

The last of the four refineries, owned by the Algemeene Petroleum Co., is located at Klantoeng. The output is relatively small. Its capacity is about 100 barrels per day. The principal product is kerosene, which is distributed locally, and the residue is used as a fuel at the plant or sold locally when a surplus exists. (3)

Sumatra:- Two of the four refineries in Sumatra are located along the northeast coast, one at Perlak on Cape Peurala, and the other at Pangkalan Peninsula. At Perlak the B.P.M. owns a complete plant for distilling and refining gasoline. The products of this plant are run through pipe lines to Pangkalan Brandon, about 70 miles, for further distribution. (4)

1: "Petroleum Refineries in Foreign Countries" Op.Cit - p.28
2: Ibid - p. 28
3: Ibid - p. 28
4: Ibid - p. 29

The B.P.M. refinery at Pangkalan Brandon is located on the Babalan River and has a capacity of 12,000 barrels. The refinery is used chiefly for the production of gasoline and kerosene. The crude oil from the northern Sumatra fields is very rich in light distillates, yielding 30 per cent,or more, of high-grade gasoline in addition to 40 per cent or more of kerosene. (1)

The other refinery operated by B.P.M. is located in the Palembang District in the southern portion of the island at Pladjoe on the Moesi River, a few miles below the port town of Palembang. This plant constitutes a complete refining unit with a daily capacity in excess of 18,000 barrels. A plant for treating kerosene is a branch of this refinery.(2)

The refinery produces almost a complete line of products, the main ones being gasoline, kerosene, lubricating oils, and grease. The crude oil is either piped to the refineries or brought down the Moesi River in barges from Kajoe. Two pipe lines connect the Kampong Muifak field with the Plajoe refinery. Still another line brings crude oil from the Melamoen district, a distance of 141 miles. (3)

The Koloniale refinery located at Soengei-Gerong is also on the Moesi River, but downstream from the Plajoe. It receives its supply of crude oil by pipelines. Its capacity is over 25,000 barrels. The principal products are gasoline and kerosene; however, the refinery produces a complete range of products except lubricating oil and asphalt.

1: "Petroleum Refineries in Foreign Countries", Op.Cit. - p. 29
2: Ibid - p. 29
3: Ibid - p. 29-30

In addition to refined gasoline, the crude oil of some of the producing fields is enriched by the addition of a good supply of natural gasoline. A wax plant is also in operation. (1)

IRAQ

An oil area which has attracted world-wide attention because of the diplomatic struggle over its control, and which may be expected to enter the ranks of important producers in the near future, is located in Iraq. The exploitation of this field is awaiting the completion of a 1150 mile pipe line which will connect this oil field with the Mediterranean at Haifa and Tripoli. Haifa, in Palestine, is under British control while Tripoli, the northern terminus, is in Syria and under French control. It is hoped to complete this pipe line by 1935, at which time the production of 30 million barrels a year will become technically possible. At present the Iraq Petroleum Co. is composed of the following interests, the percentage of whose ownership is indicated: (2)

D'Arcy Exploration Company, Ltd., (Anglo-Persian Company,Ltd.)	23.75%
Anglo-Saxon Petroleum Company, Ltd., (Royal-Dutch-Shell)	23.75%
Compagnie Francaise des Petroles (French Group)	23.75%
Near East Development Corporation, (Standard Oil Company (N.J.),Standard Oil Company of New York, Gulf Refining Company)	23.75%
Participations and Investments,Ltd. (C.S.Gulbenkian, et al.)	5.00%
	100.00%

1: "Petroleum Refineries in Foreign Countries",Op.Cit.,p.30
2: "World Resources and Industries" by Eric W.Zimmermann, Harper and Bros., Publishers, New York and London, 1933, - 841 pages - p. 492-496

SAKHALIN

The Island of Sakhalin is situated to the north of Japan and separated from the mainland of Siberia by the Gulf of Tartary. The major portion of the island belongs to Russia, the remainder to Japan. In 1925, the Japanese obtained a concession from the Russians, lasting 40 years, whereby they were granted exploitation rights over certain territories in the northern (Russian) part of the island.(1)

The production of crude from Sakhalin has mounted steadily from 1926 (23,000 tons) to date, reaching 328,570 tons in 1932. The Japanese refine their crude at refineries near Tokio, while the Russians refine at Vladivostock and Chabarovsk, which are about 600 and 1000 miles respectively away. (2)

Since the important petroleum producing fields of the Eastern Hemisphere have been considered, we will turn our attention to the important producing fields in the Western Hemisphere. Venezuela will be the first country to come under consideration.

1: "Petroleum Industry of Sakhalin", Mon.Petr.Roum. - 1933 - p. 1397

2: Ibid - Loc.Cit.

VENEZUELA

Petroleum development has been rapid in Venezuela, production jumping from 425,000 barrels in 1919 to 137,000,000 barrels in 1930, but exports in commercial quantities were not made until 1921, when 1,500,000 barrels were exported. It is estimated that, of the total area of Venezuela lying north of the Orinoco River, 35,000 square miles represent the portion within which it is possible to develop oil production. The Maracaibo Basin alone, where most of the present oil pools have been located, contains approximately 10,000,000 acres. The principal regions of activity at present are: The Maracaibo Basin; eastern Venezuela, in the States of Monagas and Sucre; and in the State of Falcon, northeast of Maracaibo. The greatest exploitation, however, has taken place in the Maracaibo Basin, where the first wells were drilled in 1914, at which time a British petroleum company drilled two test wells. Development was slow until 1923, when twenty-six wells were drilled at the south end of Lake Maracaibo. Since that time Venezuela has risen from its rank as a small producer of oil to second place in world production, which position it held until September, 1930. As a result of intensive petroleum production in the Russian fields, Russia surpassed Venezuela, where a program of curtailment has been in progress, made necessary by the world oil situation. (1)

Although oil production is primarily in the hands

1: U.S.Department of Commerce, Bureau of Foreign and Domestic Commerce, - "Commercial and Industrial Development of Venezuela" - Trade Information Bulletin No.793 - p. 26-27

of foreign companies, the direct return to Venezuela through high wages, purchase of native materials, Government royalties and taxes, has been exceedingly beneficial to the general economic condition of the country during the past few years, when the agricultural crops, upon which prosperity in general has been dependent, have been below normal and world prices low. While petroleum development has more directly benefited those sections of the country in the immediate areas of production, the country as a whole receives the indirect benefits of the industry, as evidenced by the generally satisfactory commercial situation, the sound condition of national finances, and the large amount of public works. (1)

To date, this country has produced about 3.6 per cent of the world's total oil production up to January 1, 1934. In 1932 she produced 8.33 per cent of that year's total production, her total being 118,000,000 barrels. In 1933 her production made up 8.9 per cent of the world's total, being 116,300,000 barrels.

A remarkable and sudden change took place in Venezuela through the development of its resources of petroleum. Prior to 1923 Maracaibo was known only as a coffee-exporting port, and its economic prosperity depended upon that crop. In that year certain companies which had been prospecting for oil for a number of years began to get results, and exploitation since that time has been intensive.

1: "Commercial and Industrial Development of Venezuela - Op.Cit. - p. 27-28

The rapid development brought to the oil fields hundreds of North Americans, Europeans and West Indians, and thousands of Venezuelans - from the interior states, from central, and even from eastern Venezuela. Wages for daily labor increased 100 per cent and more; prices for foodstuffs and for rentals increased to a still greater extent, and more money was put into circulation than there ever had been before. As a result, the population of the Maracaibo Basin has adopted a higher standard of living, and there has been created a demand for United States products, ranging from food to labor-saving devices. Mechanical goods especially had been adopted by the Venezuelans, as well as all kinds of imported household furnishings and office equipment. Seeing similar articles in use in the foreign colony has influenced this trend to a marked extent. (1)

Another example of changed conditions is found in the eastern section of Venezuela in the State of Monagas, where development work by the oil companies is having a decided economic effect by giving employment to hundreds of laborers, increasing their buying power and creating a market for products from the United States. The centre of these activities is in the Quiriquire field. Small stores have sprung up in the near-by village of Caripito, and there is now a condition of prosperity in the vicinity. Even Maturin, a small city of about 15,000 inhabitants, has felt the effect of this development and the stores are now much

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1: "Commercial and Industrial Development of Venezuela" - Op.Cit. - p. 27-28

better stocked, as many of the Venezuelan laborers are purchasing food products brought in from the United States.(1)

Practically all the large American oil companies, as well as many other American concerns, are interested in Venezuelan development, either directly or through their connections. Likewise, the principal English and Dutch companies, together with a number of others of different nationality, are either holders of tracts of possible petroleum lands or are carrying on developemtn. More than 100 petroleum companies were registered in Venezuela in 1930. (2)

There are in use nearly 400 storage tanks with a capacity of 85,000 to 100,000 barrels each, and a total capacity of around 20,000,000 barrels. There are in service more than 75 tanker ships capable of carrying 13,000,000 barrels of oil monthly between Lake Maracaibo points and ocean terminals. (3)

Venezuela has 1 oil refinery, 6 topping plants, 4 absorption plants, and 3 compressor plants. The refinery, which is located at Sam Lorenzo, has a daily capacity of approximately 17,000 barrels. The six topping plants have a combined daily capacity of about 8,115 barrels. The topping plants are located at Cabemas, La Salina, La Arreaga, Tarrafield, and El Mene de Acosta. The natural gasoline obtained from the absorption and compressor plants is generally turned back into crude, which is refined or exported. (4)

1: "Commercial and Industrial Development of Venezuela" - Op.Cit. - p. 28
2:
3:
4:

The oil refinery, topping plants, absorption plants, and compressor plants are all owned by subsidiaries of foreign corporations. These plants recover annually for domestic sale and export about 1,000,000 barrels of gasoline, 18,000 barrels of kerosene, 4,000,000 barrels of fuel oil, 33,744 barrels of gas oil, some 1,200 barrels of absorption oil, 51,000 barrels of distillate, and nearly 40,000 barrels of naphtha bottoms. Three topping plants producing comparatively small amounts are operated by oil companies merely to obtain products for their own use, these products not entering the local market or export trade. Much of the production from the four absorption plants and three compressor plants is turned back into crude, which is refined or exported, and it is felt that natural gasoline cannot be considered as a commercial motor fuel, as a product by itself.(1)

The total length of all pipe lines equals 249 miles. The following figures show Venezuelan oil production from 1921 to 1930, and the succeeding table shows the yearly exportation from 1926 to 1930. (2)

1: "Commercial and Industrial Development of Venezuela" - Op.Cit. - p. 29-30
2: Ibid - p. 30

PRODUCTION

Year	Thousands of Barrels	Year	Thousands of Barrels
1921	1,433	1926	36,911
1922	2,201	1927	63,134
1923	4,201	1928	105,749
1924	9,042	1929	137,500
1925	19,687	1930	137,000

EXPORTS
(Barrels of 42 Gallons)

1926	33,473,644
1927	55,605,431
1928	97,900,141
1929	127,506,932
1930	135,305,226

MEXICO

Active production in Mexico commenced in 1901 in the Ebano field in the Panuco River Basin near Tampico. In 1902 the Isthmus od Tehuantepec was explored, and in 1907 the Cougas field, now called Furbero, was opened successfully. The producing areas of Panuco and Topila in the Panuco River Basin, and the Juan Casiano and Potrero del Llano fields were discovered in 1910. Production in all fields increased rapidly to the peak year of 1921 with the "Golden Lane" of Tuxpan, when Mexico held second place in the world petroleum production with 193,397,587 barrels. Deom 1921 production declined to the estimated figure of 32,000,000 barrels in 1932. Other important field in Mexico are the Alamo in Tuxpan, the Cerro Azal in Tepezintla (Vera Cruz) and Los Naranjos in Amatlan(Vera Cruz).

Mexico's potential oil-bearing lands are estimated at 150,000,000 acres, of which about .01% has been exploited.(1)

The first refinery was started in Furbero in 1870, the combined refining capacity of Mexico being now given as 340,000 barrels per day, the chief refiners being El Aquila, Huasteca, Pierce Oil and La Corona in Tampico, and El Aquila in the Isthmus. The crude oils are of two types - the heavy asphaltic type and the light paraffin base crude, those of Tehuantepec, Tobasco, and Chapas being especially light and rich in lubricants. (2)

There has been a considerable decrease in the number of petroleum refineries in Mexico during the past few years. While there are nine refineries of a combined capacity of 332,000 barrels per day, the number in operation has been reduced to five. In addition to the five plants in operation, the Cia Mexicana de Petroleo "El Aquila", S.A., is at present rapidly contemplating a refinery in Mexico City. It is stated that the plant will begin operations early in 1932. (3)

The daily topping capacity of plants operating at Tampico is approximately 80,000 barrels, that at Minatetlow 33,000 barrels; it is estimated that the refinery at Mexico City, when completed, will have a capacity of about 10,000 barrels a day. (4)

All the operating refineries are equipped with heaters of modern type and with bubble tanks for fractionation. At Tampico, the Cia. Mexicana de Petroleo El Aquila

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3: "Petroleum Refineries in Foreign Countries 1931" - Op. Cit. - p. 25
4: Ibid - Loc. Cit.
1: Oil and Gas Journal, September 3,1933 - 31(42)16
2: Ibid - Loc. Cit.

operates a wax plant with a capacity of 1,200 tons a month. The same company operates at Tampico the only asphalt plant in the country. The capacity is 6,000 barrels. The El Aquila refinery at Minatetlow makes practically all of the lubricating oil refined in Mexico. (1)

The cracking equipment of Mexico consists of a 1,000 barrel plant operated at the Minatetlow refinery of El Aquila and a 3,000-barrel unit which is being erected by Huasteca at their Tampico plant; both of these are liquid phase. There is a vapor phase, 1,000-barrel unit operated by El Aquila at Tampico, and a similar plant is contemplated for Mexico City refinery of the same company. (2)

In general, natural gasoline is recovered at practically all the fields, but, with the exception of the plants at Francita and Agua Duke, (both El Aquila), the recovered gasoline is mixed back with the crude for pumping to the refineries. The Agua Duke plant produces 320,000 gallons per month and the Francita 52,000 gallons of natural gasoline which is blended at the refinery. The Agua Duke plant includes a stabilizer. (3)

COLOMBIA

The only petroleum refinery in Colombia is that of the Tropical Oil Co., located at Borranca Bermeja, a port on the lower Magdalena River. The crude treated there comes entirely from wells belonging to the Company. The nearest

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1: "Petroleum Refineries in Foreign Countries 1931" - Op. Cit. - p. 25-26
2: Ibid - Loc.Cit.
3: Ibid - Loc.Cit.

of the wells are situated about 12 miles from Borranca Bermeja. The crude stills are provided with modern overhead equipment of the bubble-tower type and have a potential capacity of approximately 7,000 barrels of crude per day. During 1930, the crude oil throughout averaged 3,500 barrels a day, the yield being approximately 67 per cent fuel oil, 22 per cent gasoline, and the remainder kerosene and internal-combustion-engine oil. A lubricating plant with vacuum-still equipment was completed and placed in operation during December 1930. (1)

According to figures published by the Ministry of Industries of the Colombian Government, the production of petroleum products in this country during 1930 was as follows:

	Barrels
Gasoline	285,144
Kerosene	55,675
Absorption Oil	17,665
Fuel Oil	818,693
Lubricating Oil	17,024

The Andian National Corporation (Ltd) operates a 375-mile pipe line with a daily capacity of 50,000 barrels extending from Borranca Bermeja to the port of Cartagena on the Caribbean Sea. (2)

The other countries of South America which produce less than one per cent of the world's production of petroleum in a year are Argentina, Peru, Trinidad, and Ecuador. They will be separately taken up in that order.

1: "Petroleum Refineries in Foreign Countries" - Op.Cit. - p. 9
2: Ibid - Loc. Cit.

ARGENTINA

Argentina to date has produced only about .45 per cent of the world's total production. In 1932 her share amounted to .99 per cent and in 1930 this percentage was .98.

There are at present in operation 15 petroleum refineries having a total daily capacity of about 46,000 barrels of crude petroleum. In addition, two other refineries, with a combined capacity of 17,500 barrels daily, are nearing completion. All of the important refineries, existing and under construction, are equipped to do both topping and cracking. The smaller plants do topping only. (1)

Information concerning the production in the refineries of the various products such as gasoline, fuel oil, etc., is available only for the Yacimientos Petroliferos Fiscales (Argentine Government) and the Cia Ferrocarrilera de Petroleo. (2)

The refinery of the Cia Ferrocarrilera de Petroleo produces gasoline and fuel oil; the proportion is one barrel of gasoline to four barrels of fuel oil. (3)

There are no long oil pipe lines in Argentina, although from time to time proposals have been made for their construction. Diadema (Royal Dutch) operates a pipe line from the Commodoro Rivadavia field to the coast. This line has a capacity of 7,000 barrels a day and is 27 kilometers in length. (4)

There is but small production of natural or casinghead gasoline in Argentine oil fields; the quantity ontained

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1: U.S.Department of Commerce, Trade Information Bulletin No.784 - "Petroleum Refineries in Foreign Countries" p.1
2: Ibid
3: Ibid
4:"Petroleum Refineries in Foreign Countries",Op.Cit.-p.2

from Commodoro Rivadavia during 1929 amounted to only 118,308 barrels, compared with 68,336 and 42,806 barrels obtained during 1928 and 1927, respectively. This gasoline has generally had an average gravity of 79.5 A.P.I. The Cia Merrocarrilera de Petroleo during 1928 and 1927 produced 12,137 and 9,579 barrels, respectively, of natural gasoline. Private companies operating in the Plaza Huincul field produced 1,838 barrels of natural gasoline in 1928 and 9,441 in 1929. (1)

PERU

Peru is tenth in world production, having yielded .64 per cent to date or 154,875,000 barrels. She produces yearly from 10,000,000 to 14,000,000 barrels. (2)

There are two petroleum refineries in Peru, one belonging to the International Petroleum Co., of Canada, and the other to the Establecimiento Industrial de Petroleo de Zorritos, owned by Faustino G. Piaggio Sociedad (Ltda.), Callao, Peru. (3)

The refinery of the International Petroleum Co., located at Talara, has a daily capacity of 16,800 barrels of crude and storage space for approximately 2,000,000 barrels. (4)

The Establecimiento Industrial de Petroleo de Zorritos operates a refinery, employing the batch process, at Zorritos, Peru. Its capacity is about 1,000 barrels a day, although it now treats only 220 barrels. In addition,

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1: "Petroleum Refineries in Foreign Countries" - Op.Cit. - p.2
2: Ibid - p. 31
3: Ibid - p. 31
4: Ibid - Loc.Cit.

there is a small plant for the chemical treatment of kerosene. There is a storage capacity of 3,500 barrels of refined products and about 5,000 barrels of crude. (1)

The production of the LaBrea y Parinas fields is over 1,800 barrels a day, and the product is about 79 A.P.I. gravity; that of the Lobitos fields is around 250 barrels a day and averages 76 degrees A.P.I. (2)

TRINIDAD (3)

Trinidad only produces about 10,000,000 barrels a year, yet has four very fine refineries.

The Trinidad Leaseholds refinery is a thoroughly modern plant. It includes three topping plants, a four-unit cracking plant, and a kerosene-oil installation. There are good storage facilities and convenient docks and other shipping requisites.

The plant of the United British Refineries is also a modern refinery, using the Trumble system.

The Trinidad Lake Asphalt Operating Co. (Ltd) uses the products of its refinery in recovering lake asphalt. The plant is a fairly modern topping installation.

The West India Oil Co. refinery is also a fairly modern topping plant; that of the Trinidad Central Oil Fields uses the batch system.

ECUADOR

Two petroleum companies with major investments of British capital are operating in Ecuador. One of these

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1: "Petroleum Refineries in Foreign Countries",Op.Cit.,p.31
2: Ibid - Loc. Cit.
3: Ibid - p. 39

companies brought in a two thousand barrel well early in 1931 and the other a two hundred and fifty barrel well more recently. Local refineries supply approximately 65 per cent of the gasoline consumed in Ecuador, while the remainder is imported at present from Persia. (1)

The following official figures for refined products are from a report of the Consul-General, based on information published by the Ministry of Finance and the Inspector General of the Mines:

Production of Refined Products in Ecuador

Item	1929 (Gallons)	1930 (Gallons)
Commercial Gasoline	1,385,162	1,848,153
Kerosene	1,073,659	1,096,410
Lubricating Oil	33,414	33,210
Gas Oil	212,981	129,388

The following is the total production (in barrels of 42 gallons) of crude oil in Ecuador, according to the same source of information: (2)

1925	139.671
1926	316,923
1927	407,177
1928	1,083,676
1929	1,345,753
1930	1,552,916

Exports of crude oil from Ecuador were as follows (in metric tons) in the years indicated:

1927	46,761
1928	122,961
1929	156,164
1930	161,102

1: U.S.Department of Commerce, Bureau of Foreign and Domestic Commerce, Trade Information Bulletin No.773,"Economic and Financial Conditions in Ecuador", 1931 - p.11
2: Ibid - Loc. Cit.

During the three years 1928-1930, the bulk of the crude oil exported went to the United States. Total exports of gasoline in 1929 amounted to 328,558 kilos valued at 157,335 sucres, and in 1930 totaled 239 kilos valued at 191,661 sucres. Practically all the shipments of gasoline at this time went to Colombia. (1)

There are three petroleum refineries in Ecuador. During 1930, 160,456 barrels of crude oil were treated, compared with 146,592 barrels in 1929. The crude oil treated comes entirely from wells belonging to the operating companies, all located on the Santa Elena Peninsula, Province of Guayas.

The wells of the Anglo-Ecuadorian Oil Fields (Ltd) are near Ancon, about 9 miles from the refinery, to which the crude oil is pumped through a pipe line. Their daily yield in 1930 was approximately 4,167 barrels. This rose to 5,000 barrels the next year, as a new producer well was brought in. The Ecuador Oil Fields (Ltd) has its wells near the refinery at Cantiva. Its yield runs about 290 barrels a day. (2)

Neither natural gas nor casing-head gasoline is produced in Ecuador. Natural gas from the oil wells is piped from the casing-head to the boilers, where it is used as a fuel to make steam for operating the pumps. It is not metered, nor its quantity measured in any way.

The refinery of the Anglo-Ecuadorian Oilfields (Ltd),

1: "Economic and Financial Conditions in Ecuador" - Op.Cit. - p. 11
2: U.S.Department of Commerce,Bureau of Foreign and Domestic Commerce, Trade Information Bulletin No. 784 - "Petroleum Refineries in Foreign Countries 1931" - 1932 - p. 11

at the Libertad, is the only modern one in Ecuador. The equipment consists of shell stills, and both continuous and batch methods are used.

The equipment of the refinery of the Ecuador Oil Fields (Ltd) at Salinas, consists of three small shell stills, while the Viggiani refinery is also using antiquated equipment, consisting of shell stills. (1)

1: Trade Information Bulletin No. 784 - Op.Cit. - p. 11

CHAPTER VI

AMERICAN PARTICIPATION IN WORLD MARKETS

Imports

To be marketable, crude oil supplies which are developed in remote countries must find their way to refineries and be converted into salable products in the form of refined oils. The United States, in the development of its own petroleum resources, has built up a great refining industry. Its facilities for manufacturing the products which are in demand have attracted, and will continue to attract, foreign raw material which includes crude petroleum and fuel oil, in addition to topped petroleum. Furthermore, its position in supplying the world with petroleum products will remain important until such time as foreign production and refining facilities are far more extensively developed than they are at present. (1)

For these reasons, imports of oil into the United States do not indicate with any exactitude the barrelage extent of America's actual dependence upon foreign oil. Most of the oil imported is of heavy quality suitable for use chiefly as fuel oil, and much of it enters marine use. Some is "topped" or refined, however, and with modern refining methods, an increasing gasoline recovery is being obtained.(2)

The following data, obtained from the Bureau of

1: Division of Public Relations, American Petroleum Institute, "Petroleum Facts and Figures"second edition, p. 89
2: Ibid - p. 90

Foreign and Domestic Commerce of the United States Department of Commerce, will show how much of each product was imported during 1933. Note that fuel oil, including topped oil, made up 99.6 per cent of the total amount imported.

Imports of Refined Oils for 1933

	Barrels
Fuel Oil, including Topped Petroleum	13,932,977
Unfinished Distillates	19,195
Finished Light Products	25,070
Illuminating Oil	8,752
Lubricating Oil	4,295
Total Imports	13,990,289

A large decrease in imports of refinery products to United States in 1933 was for the most part due to taxes imposed by the Federal Government in 1932. The figures for 1933 are 13,990,289 barrels as compared to 29,812,000 barrels for 1932. (1)

These taxes have greatly aided the market for California products in Eastern states. The import taxes on crude oil and refinery products,which first became effective in June, 1932, have practically stopped the importation of several refinery products, especially kerosene and lubricating oil, and this decline, which is confined to the East Coast and the Gulf Coast, has created a greater demand for California oils, particularly the heavier products. (2)

Imports of crude oil and refinery products totaled

1: Oil and Gas Journal - January 25, 1934 - p. 12
2: Ibid - p. 12

only 46,271,000 barrels as compared with the 1932 total of 74,494,000 barrels, a decline of 38 per cent.

As seen in the following table - No. 5 - the United States imports most of its crude petroleum from Venezuela, Colombia, and Mexico. Imports of this crude oil have been steadily decreasing during the last five years - i.e. 1929-1933, inclusive.

In addition to this, our imports of refined oils have been falling off also. Our chief sources of refined oils or, more correctly, topped oil, as this product makes up 99 per cent of our imported oils, are: The Dutch West Indies, Mexico, Venezuela, and Canada. The Dutch West Indies is the leader with 88 per cent.

TABLE 5

IMPORTS OF CRUDE OIL INTO UNITED STATES BY COUNTRIES

(in Thousands of Barrels of 42 U.S.Gallons)

	SOURCE						
Year	Mexico	Dutch West Indies	Venezuela	Colombia	Peru	Others	Total
1929	12,663	16,225	34,413	12,620	1,454	1,540	78,915
1930	10,093	9,780	25,299	14,204	1,281	1,472	62,129
1931	8,207	4,103	21,122	12,329	225	1,489	47,250
1932	7,147	-----	17,555	10,550	120	1,357	44,682
1933	5,866	-----	17,218	7,688	19	2,080	32,773

Source: U.S.Department of Commerce.

TABLE 6

IMPORTS OF REFINED OILS INTO THE UNITED STATES BY COUNTRIES

(in Thousands of Barrels of 42 U.S.Gallons)

	SOURCE						
Year	Mexico	Dutch West Indies	Venezuela	Canada	Germany	Others	Total
1929	2,075	25,824	64	562	61	1,255	29,777
1930	1,907	39,436	202	365	167	1,412	43,489
1931	1,310	35,436	133	333	98	1,527	38,837
1932	2,130	25,991	48	413	58	1,172	29,812
1933	746	12,651	77	516	8	417	13,498

Source: U.S.Department of Commerce.

Exports

Crude oil and each of its refined products are subject in export, as well as in domestic commerce, to distinctly different trade factors. Although the various products come from a common source, they are almost totally different as regards factors of supply and demand. Exports of crude oil are negligible as compared with total domestic production and imports. The bulk of the outgoing crude oil goes across the border by pipe-line to supply Canadian refineries. (1) According to statistics of the United States Department of Commerce, 75 per cent of the crude oil exported in 1931 went to Canada, 66 per cent in 1932, and 50.3 per cent in 1933.

The exportation of kerosene and lubricating oils consumes a considerable proportion of the total of both domestic production and imports. The exportation of gasoline, and of gas oil and fuel oil is relatively small. (2)

American foreign sales of petroleum products have shown steady and consistent gains during recent years as demonstrated by the fact that exports of such products from the United States increased from a value of almost $452,000,000 in 1925 to more than $562,000,000 in 1929 - an increase of $110,000,000 during a period of four years, or an average annual gain of some $27,000,000. Refined petroleum oils accounted for more than 85 per cent of such foreign sales. Gasoline is the largest single item in the list of petroleum exports from the United States, exports of this commodity during 1929 being valued at almost

1: Division of Public Relations, American Petroleum Institute, "Petroleum Facts and Figures", second edition, p. 31
2: American Petroleum Institute - Loc. Cit.

$267,000,000. Exports of petroleum products as a group take third place among major classifications of American exports and rank second among manufactured or processed commodities exported. (1)

The growing production of crude petroleum and the development of refineries abroad, with the resultant competition in refined petroleum products, make it increasingly important that the American producer and exporter should keep posted concerning foreign markets and their trend.(2)

The United States occupies an outstanding position in the international trade of these products, its foreign sales of such products being about equal to that of the rest of the world combined. (3)

About 25 per cent of the oil consumed in foreign countries is exported from the United States. Ten American companies control the bulk of this trade. More than one-half of the gasoline shipments are exported to Europe, about one-fifth to the other Americas, and one-tenth to the Far East and Australia. Africa is a small gasoline consumer. The United Kingdom has bought nearly one-third of our exportable surplus. France has purchased about one-half of this quantity, and Canada has been third in importance. China is our largest consumer of kerosene, and the United Kingdom and Japan are about tied for second place. The largest importers of our lubricating oils are France and the United Kingdom, and substantial volumes are exported to Belgium,

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1: U.S.Department of Commerce - Trade Promotion Series #99, "International Trade in Petroleum and its Products - 1929", 1930 - 175 pages - p. 1
2: Ibid - p. 1
3: Ibid - p. 1

Germany, British India, and Australia. The most extensive exports of fuel oil are made to Chile, Panama, and Japan;and the United Kingdom, Germany, Canada, Cuba, and Argentina are also important buyers. (1)

Our chief customers of crude oil are,in order of their importance: Canada, Europe with France predominant, Japan, and Cuba. Our exports to Canada have remained steady during the last four years. On the other hand, our crude oil export to Japan and Europe is growing every year. Our biggest customer is Canada, which took 50 per cent of our total export in 1933.

Concerning the export of refined oils, our customers are, in order of importance: The United Kingdom, Japan,France, Canada and Germany. The United Kingdom is our chief customer, leading all countries in purchases of gasoline, kerosene, lubricants, and wax. Exports of gas oil and fuel oil to Japan continue to increase and are at a relatively high level. Our exports of refined oils to France, Canada, and Germany have decreased during the past five years. (2)

1: Osborn,C. - p. 289-290
2: U.S.Department of Commerce, "Crude Petroleum and Petroleum Products in 1931", by G.R.Hopkins and A.B.Coons,p.663

TABLE 7

EXPORTS OF CRUDE OIL FROM THE UNITED STATES BY COUNTRIES

(in Thousands of Barrels of 42 U.S.Gallons)

DESTINATION						
Year	Canada	Japan	Europe	Cuba	Others	Total
1929	22,412	2,476	323	701	482	26,394
1930	18,967	2,926	959	512	341	23,705
1931	19,209	3,606	620(France)	769	542	25,535
1932	18,132	4,877	3,404(France)	233	658	27,393
1933	19,501	5,533	9,143(France)	313	2,213	36,703

Source: U. S. Department of Commerce

TABLE 8

EXPORTS OF REFINED OIL FROM THE UNITED STATES BY COUNTRIES

(in Thousands of Barrels of 42 U.S. Gallons)

DESTINATION						
Year	United Kingdom	France	Japan	Canada	Germany	Australia
1929	25.720	11,885	7,715	8,049	5,159	4,828
1930	27,263	11,908	8,083	7,142	5,809	4,075
1931	19,194	8,450	7,302	5,307	3,904	3,001
1932	15,064	6,298	7,144	4,216	2,617	4,196
1933	11,279	6,815	6,578	2,598	2,338	3,441

Year	Netherlands	Belgium	China	Others	Total
1929	4,364	2,898	4,469	61,632	136,719
1930	4,131	3,276	3,640	57,467	132,794
1931	3,964	2,826	2,755	42,156	98,859
1932	3,279	2,362	2,521	28,185	75,882
1933	2,539	2,365	2,035	29,834	[illegible]

TABLE 9

U. S. PRODUCTION, IMPORTS and EXPORTS OF ALL OILS *
(in Thousands of Barrels of 42 U.S.Gallons)

Year	Production	Imports	Exports
1918	355,928	38,943	67,056
1919	378,367	54,161	62,758
1920	442,929	108,794	77,279
1921	472,183	128,776	70,315
1922	557,531	135,947	72,702
1923	732,407	99,608	100,058
1924	713,940	94,534	115,207
1925	763,743	78,137	111,747
1926	770,874	81,284	129,029
1927	901,129	71,662	131,242
1928	901,474	91,167	145,120
1929	1,005,594	108,567	153,550
1930	898,011	105,618	156,499
1931	851,081	86,087	124,394
1932	785,159	74,494	103,275
1933	898,874	46,271	106,525

* Includes crude petroleum and refined products.

Source: U.S.Department of Commerce.

TABLE 10

PERCENTAGE OF CRUDE OIL and REFINED OILS
in IMPORTS and EXPORTS

Year	Imports		Exports	
	Crude Oil	Refined Oils	Crude Oil	Refined Oils
1918	96.9	3.1	8.8	91.2
1919	97.5	2.5	10.0	90.0
1920	97.6	2.4	11.1	88.9
1921	97.3	2.7	13.6	86.4
1922	95.8	4.2	14.7	85.3
1923	82.3	17.7	17.2	82.8
1924	82.3	17.7	15.5	84.5
1925	79.1	20.9	11.8	88.2
1926	74.2	25.8	12.0	88.0
1927	71.8	28.2	12.1	87.9
1928	87.4	12.6	13.1	86.9
1929	72.7	27.3	17.2	82.8
1930	58.8	41.2	15.2	84.8
1931	54.9	45.1	20.5	79.5
1932	60.0	40.0	26.5	73.5
1933	70.8	29.2	34.5	65.5

Source: U.S.Department of Commerce

CONCLUSION

In the preceding pages we have attempted to show just how foreign oil developments have affected the American petroleum industry. The facts show that the United States, once omnipotent in refining and producing activity, has been steadily losing ground to other foreign countries which are now forging ahead steadily in production and refining. Directly this means that less crude petroleum is being shipped to this country for refining purposes, due to the growth of refineries abroad. Moreover, our exports of refined oils will continue to drop, due to the growing independence of these foreign countries, and figures bear this out. In addition to this, our exports of crude are growing, showing that this country is now shipping out oil which will, in turn, be refined in other countries. All this goes to prove that foreign refining capacity is increasing more rapidly than foreign demand for refined petroleum products.

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